DESCRIPTION

The BFD is a large (38.5” x 19”) LED display (128 x 64 pixel resolution) which is driven from the RS485 port of a G3. The BFD is built using 32 display boards in an 8 column by 4 row configuration. When used with a G303, the BFD will display the contents of the current G3 page. When used with larger G3s, the desired information is selected by using a “display primitive” on the current G3 page. Multiple BFDs can be driven from a single G3 (see Using Multiple BFDs with a single G3). The exact number is dependent upon the lengths of the individual wiring runs. Contact Red Lion Tech Support for more info.

The display is housed in a welded steel enclosure and the display window (0.118” thick red acrylic) is sealed to the enclosure using a gasket and bezel strips. The gasketed rear panel is bolted to the enclosure. The ventilation slots and internal fan are designed to provide adequate cooling in a normal industrial environment. The enclosure is designed to hang from an overhead support.

The BFD enclosure can be easily converted for indoor NEMA 4 operation using the optional BFD NEMA 4 conversion kit. The kit includes a sealed cover plate (to plug the vent hole), an external “cabinet cooler” (to replace the internal fan) and a DIN-rail mounted power supply to operate the “cabinet cooler”.

Power to the BFD is provided by a universal AC input power supply. The AC power and the G3 RS485 cable enter the enclosure thru separate conduit fittings. The AC power connects to the power supply via a removable 3 position terminal block. The RS485 signal connects to the communication board via either an RJ45 modular plug or a removable 2 position terminal block.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the literature or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

CONTENTS OF PACKAGE

- G3BFDM Display
- Hardware kit including #8-32 screws & #8 flat washers for the rear cover; air filter, retainer and this instruction booklet.
- Mounting kit including eyebolts, locknuts, conduit fittings & seals & hole plugs

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
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<tr>
<td>BFD</td>
<td>Big Flexible Display</td>
<td>G3BFDM00</td>
</tr>
<tr>
<td></td>
<td>Big Flexible Display NEMA 4 Kit</td>
<td>G3BFDNEM</td>
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<tr>
<td>Crimson</td>
<td>Crimson 2.0 for G3</td>
<td>SFCRM200</td>
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<tr>
<td>CBL</td>
<td>10-foot RS485 cable for communications between G3 and G3BFD</td>
<td>CBLRLOC04</td>
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<tr>
<td></td>
<td>Replacement Display Module</td>
<td>G3BFDDSP</td>
</tr>
<tr>
<td></td>
<td>Replacement Fan Filter</td>
<td>G3BFDUL</td>
</tr>
</tbody>
</table>

Notes:
1. NEMA Type 4 protection is only available as a field (customer) installed option. Even though the use of this conversion kit provides the BFD with NEMA Type 4 protection, it is not intended to be operated outdoors in direct sunlight.
2. Visit www.redlion.net/g3 for additional features, options and drivers for your G3.
3. Use this part number to purchase Crimson 2.0 on CD with a printed manual, USB cable, and RS-232 cable. Otherwise, download from http://www.redlion.net/g3
SPECIFICATIONS

1. POWER: Universal AC input (100 - 240 VAC 50/60 Hz); 2.0 A @ 120 VAC; 1.0 A @ 240 VAC. Power connection via removable three position terminal block. The 5 VDC supply to the BFD display boards is protected by two in-line 25 A automotive blade type fuses in the wiring harness (Littelfuse #257.025 or equivalent).

2. DISPLAY: 128 x 64 resolution using 0.2” (5.08 mm) diameter red LED pixels. Overall display measures 38.5” (977.9 mm) x 19” (482.6 mm).

3. COMMUNICATIONS: Connects to the host G3 thru RS485 port via either RJ45 or a removable 2 position terminal block; 115,200 baud, 8 bit, 1 stop bit, no parity. The RS232 ports (either the COMMs or PGM ports) may also be used with the appropriate RS232 to RS485 converter. Note that the RS232 and RS485 ports provided by the Expansion card are not currently supported. Isolation for communications: 2500 Vrms Isolation for common: 1000 VDC for 60 seconds.

4. ENVIRONMENTAL CONDITIONS:
   Operating Temperature: 0 - 50°C
   Storage Temperature: -10 - 60°C
   Operating and Storage Humidity: 80% maximum relative humidity (non-condensing) from 0 to 50°C
   Altitude: Up to 2000 meters

5. CERTIFICATIONS AND COMPLIANCES: Contact your Red Lion Controls distributor for more information.

6. CONSTRUCTION: Welded steel enclosure with sealed red acrylic display window. Removable gasketed rear cover attaches with bolts. Welded mounting blocks to receive 3/8” (9.53 mm) eyebolts (provided) for suspension. Suspension eyebolts and locknuts are included. See “Mounting Instructions” for more info. Refer to local safety codes for additional requirements.

7. MOUNTING REQUIREMENTS: Suspend from overhead truss or other suitable structure using cable or chain capable of supporting the BFD. The angle of the display can be adjusted by altering the length of the front suspension cables (or chains) relative to that of the rear cables (or chains). Further adjustment is possible by threading the eyebolt farther into the mounting block as shown. It is critical that the minimum thread exposure shown in Figure 1 is maintained.

   Note: Loads must always be applied to each eyebolt in the plane of the eye, not to some angle to this plane.

8. WEIGHT: 117 lbs. (53.07 Kg)

INSTALLING THE BFD

MOUNTING INSTRUCTIONS

This display is designed to be suspended from a ceiling truss or other suitable structure capable of supporting the BFD. Extreme caution should be exercised when hanging the display to provide for the safety of personnel. Install ALL four eyebolts (provided) into the holes of the mounting blocks (see Figure 1). The eyebolts should be installed so that enough of the threads are exposed at the bottom of the mounting block that the four locknuts (provided) can be fitted with a minimum of one thread exposed (see Figure 1). Note that the eyebolt must be orientated so that the load is applied in the same plane as the loop of the “eye” (see Figure 1).

The angle of the display can be adjusted by altering the length of the front suspension cables (or chains) relative to that of the rear cables (or chains). Further adjustment is possible by threading the eyebolt farther into the mounting block as shown. It is critical that the minimum thread exposure shown in Figure 1 is maintained.
POWER CONNECTIONS

Access to the electrical connections is provided by removing the rear cover of the BFD. The BFD enclosure provides four holes to receive 2 - ½ inch conduit fittings (two on the top of the enclosure and two on the right side of the enclosure as viewed from the rear of the enclosure). Install the conduit fittings and water tight conduit seals in the desired positions (place the indicated surface of the seal against the BFD enclosure to guarantee a proper seal. See Figure 2) and install the hole seals into the remaining holes.

The protective conductor terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing system.

Using one of the conduit fittings, connect the AC power to one of the available removable terminal blocks on the DIN rail mounted wiring assembly. A separate earth grounding point is provided. The AC input must be able to supply the BFD with 2.0 A @ 120 VAC 60 Hz or 1.0 A @ 240 VAC 50 Hz. Be certain the chassis of the BFD is properly earth grounded and correctly protected with circuit breaker protection before applying power to the unit. Refer to Figure 3.

COMMUNICATIONS CONNECTION

The RS485 cable from the G3 should enter the enclosure using the conduit fitting not used by the power connections and should be connected to the BFD communications board via either the 2 position removable terminal block or the RJ45 jack. See Figure 3.

FAN FILTER INSTALLATION & REPLACEMENT

The fan filter and filter retainer are located in the BFD Hardware Pack. Place the filter into the retainer. The retainer will snap onto the filter mounting plate (which is attached to the BFD case. See Figure 4). This filter can be cleaned by rinsing it with water and allowing it to dry.
INSTRUCTIONS FOR INSTALLING THE OPTIONAL NEMA 4 COOLING KIT

1. Turn off AC power to the BFD at the circuit breaker.
2. Remove the rear cover of the BFD. DO NOT REMOVE THE FRONT WINDOW IN AN ATTEMPT TO GAIN ACCESS TO THE INSIDE OF THE BFD.
3. Disconnect the fan cable assembly (Figure 5a).
4. Remove the 4 kep nuts holding the fan in place (Figure 5b). These parts are no longer needed.
5. Holding the gasket and the blank vent cover plate (Figure 6a) in place to cover the fan opening, insert and tighten 8 screws (all supplied as part of the NEMA 4 kit). Care must be taken during this step to assure the integrity of the NEMA 4 seal.
6. Remove the 8 screws holding the vent plate (Figure 5c). Discard the vent plate.
7. Insert the cooling assembly from the outside so that the fans are positioned up and the wires are inside the enclosure (Figure 6b). Note that the gasket must be placed between the assembly flange and the enclosure. Insert and tighten the 8 screws. Care must be taken during this step to assure the integrity of the NEMA 4 seal.
8. Install the NEMA 4 power supply onto the din rail strip inside the BFD enclosure (Figure 6c).
9. Connect the 3 position removable terminal block (Figure 6d) from the NEMA 4 power supply to the open socket (Figure 3b) on the DIN rail wiring assembly.
10. Connect the 2 wire cable assembly from the NEMA4 power supply to that of the cooling assembly (Figure 6b).
11. Replace the rear cover, assuring that the seal is in good condition.
12. Turn on AC mains power to the BFD at the circuit breaker. The NEMA 4 cooling assembly fans will run continuously.

PROGRAMMING THE DISPLAY

When programming the G3 using Crimson 2.0, the display information for the BFD is selected by using the “display primitive” on the active display page. Any information contained within the primitive’s borders will be sent to the BFD.

BFD SOFTWARE DRIVER

The “Big Flexible Display” driver must be selected in Crimson 2.0 under the “Red Lion” drivers. A G3 unit must be used with this driver. The driver can be used on either the RS232 or RS485 port of the G3. However, only a RS485 port is included on the BFD. If RS232 is used an Rs232 to Rs485 serial converter must be used. Red Lion offers the ICM5 for just such tasks.

Note the “Big Flexible Display” driver is considered a master protocol. Therefore the other communications port can be used for another master protocol driver, but cannot be used for a slave protocol driver.

CRIMSON SOFTWARE

The BFD requires the use of Crimson 2.0 build 191 or later. The latest version of the software is always available from the website, and updating your copy is free.
USING MULTIPLE BFDs WITH A SINGLE G3

MULTIPLE BFDs DISPLAY THE SAME INFORMATION

Although most of the expected applications for the BFD use a single BFD and a G3, the design allows some flexibility for those applications where more than one BFD is required.

Up to 7 BFDs maybe connected to a single serial port, each one identified by a unique address in the range 0..6. The address is set by DIP switch positions 1, 2 & 3, eg, to set BFD address to 6, set 1 and 2 ON, and 3 OFF. Note that each of the 32 display boards in the BFD will have to have these DIP switches set for the same unit address. Power must be cycled OFF, then ON so that the new DIP switch values will take effect.

The remote display primitive describes a region of the current Display page to be rendered on a BFD. The configuration of each “remote display primitive” includes the logical serial port that the BFD is connected to, and the unit address of the BFD as set by it’s DIP switches. By placing more than one “remote display primitive” on the G3's Display Page, each BFD can be made to display different information.

A BFD may show the same information as another BFD on the same serial port by simply setting the unit addresses the same on both units. To show the same information on BFDs on different serial ports, simply overlay the remote display primitives on the current Display page and configure the logical port and BFD address as appropriate.

The display information from the G3 must be passed to each BFD. The easiest way to do this is to wire to the unused RS485 connector in the first BFD (See Figure 3a) and connect it to the second unit (daisy chain wiring). Power for each unit can be wired as normal.

TROUBLESHOOTING

REPLACING A DISPLAY BOARD

The display boards are held in place by a display frame assembly, which is built from nine aluminum display rail extrusions. The extrusions have a slot on each side to receive the PC board edge of the display boards. The boards simply slide into place. A male right angle connector on the top side of the board mates with a female connector of the board above it, thus, passing the power and signal from the top board to the bottom board. In normal operation, the display frame is fastened to the enclosure using 4 nuts (Figure 8a). However, these nuts can be removed to service the display, if required. The display frame has a pivot point along the bottom edge, which allows the top edge of the frame to tilt outside the enclosure, providing access to the top display boards. Display boards are easily removed by disconnecting the appropriate wiring connection from the top board (Figure 7b), separating the boards and sliding them out the top of the frame assembly (Figure 8).

Each display board has a 8 circuit dip switch which is used to set its location address. This address is determined by the board’s physical location within the BFD display (Figure 7a).

1. Turn off AC mains power to the BFD at the circuit breaker.
2. Remove the AC mains 3 position removable terminal block (Figure 3c).
3. Remove the AC mains position removable terminal block (Figure 3c).
4. Disconnect the main wiring harness connector (Figure 10a) from the power supply. Disconnect the fan cable assembly (Figure 5a) or the NEMA 4 cooler cable assembly (Figure 6b). Disconnect the RS485 cable to the G3 (Figure 3a).
5. Remove the 6 #8 kep nuts which fasten the power supply subassembly to the enclosure. Remove the power supply subassembly (Figure 8b).
6. Remove the 4 #8 kep nuts which fasten the display frame assembly to the front of the enclosure (See Figure 8a). The display frame assembly will now tilt back to allow access to the display boards.
7. Lift off the display frame top stop bracket (See Figure 8).
8. Locate the column of display boards with the faulty display board and remove the two wiring cables (which connect the main wiring harness to the top display board, Figure 7b).
9. Remove the appropriate board (See Figure 8). Note the DIP switch setting (Figure 7a) on the old board.
10. Change the DIP switch setting on the replacement board and install the new board in the same position as the old board. Make sure that the board-to-board pins are properly aligned.
11. Re-connect the two wiring bundles observing the proper orientation of the connectors (Figure 7b).
12. Repeat steps 1 through 7 in reverse order.
13. Note that if the DIP switch setting on a board must be changed (due to incorrect setting), the power to the unit must be cycled in order for the change to take effect.

FIGURE 7
OTHER DISPLAY PROBLEMS
If the BFD display does not look correct (as compared to that of the G3), re-check the DIP switch settings of the BFD display boards. Cycle the power to the BFD if any changes are made to the DIP switches.

If either the left or the right half of the display does not operate, check and replace (if necessary) the in-line fuse in the wiring harness (Figure 10b).

TROUBLESHOOTING YOUR BFD
If for any reason you have trouble operating, connecting, or simply have questions concerning your new BFD, contact Red Lion’s technical support.

EMAIL: techsupport@redlion.net
Web Site: http://www.redlion.net
LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
**GENERAL DESCRIPTION**

The Large Display is a versatile display available as a DC volt, current, or process meter with scaling, serial communications and dual relay outputs. The 5 digit displays are available in either 2.25” or 4” high red LED digits with adjustable display intensities. The 2.25” high models are readable up to 130 feet. The 4” high models are readable up to 180 feet. Both versions are constructed of a NEMA 4X enclosure in light weight aluminum.

All models also come with dual Form C relay outputs and RS232 / RS485 serial communications.

**SAFETY SUMMARY**

All safety regulations, local codes and instructions that appear in this and corresponding literature, or on equipment, must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

The protective conductor terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing system.

**SPECIFICATIONS**

1. **DISPLAY**: 2.25” (57 mm) or 4” (101 mm) intensity adjustable Red LED
2. **POWER REQUIREMENTS**:
   - AC POWER: 50 to 250 VAC 50/60 Hz, 18 VA
   - DC POWER: 21.6 to 250 VDC, 11 W
   - DC Out: +24 VDC @ 100 mA if input voltage is greater than 50 VAC/VDC
     +24 VDC @ 50 mA if input voltage is less than 50 VDC
3. **INPUT RANGES**: Jumper Selectable
   - D.C. Voltages: 200 mV, 2 V, 20 V, 10 V
   - D.C. Currents: 200 µA, 2 mA, 20 mA, 200 mA
   - D.C. Process: 4 to 20 mA, 1 to 5 VDC, 0/1 to 10 VDC

**ORDERING INFORMATION**

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<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
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<td>LD2A</td>
<td>2.25” High 5 Digit Red LED Volt/Current Meter with Relay Output and RS232/RS485 Serial Communications</td>
<td>LD2A05P0</td>
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<tr>
<td>LD4A</td>
<td>4” High 5 Digit Red LED Volt/Current Meter with Relay Output and RS232/RS485 Serial Communications</td>
<td>LD4A05P0</td>
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**DIMENSIONS**

<table>
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<th>PART NUMBER</th>
<th>X (Length)</th>
<th>Y (Height)</th>
<th>Z (Center)</th>
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<tbody>
<tr>
<td>LD2A05P0</td>
<td>16 (406.4)</td>
<td>4 (101.6)</td>
<td>12 (304.3)</td>
</tr>
<tr>
<td>LD4A05P0</td>
<td>26 (660.4)</td>
<td>7.875 (200)</td>
<td>22 (558.8)</td>
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</table>
4. USER INPUT:
   User Input: Software selectable pull-up (8.6KΩ) or pull-down resistor (3.9 KΩ) that determines active high or active low input logic.
   Trigger levels: VIL = 1.0 V max; VIH = 2.4 V min; VMAX = 28 VDC
   Response Time: 5 msec typ.; 100 msec debounce (activation and release)

5. COMMUNICATIONS:
   RS485 SERIAL COMMUNICATIONS
   Type: RS485 multi-point balanced interface (isolated)
   Baud Rate: 300 to 38.4 k
   Data Format: 7/8 bits; odd, even, or no parity
   Bus Address: 0 to 99; max 32 meters per line
   RS232 SERIAL COMMUNICATIONS
   Type: RS232 half duplex (non-isolated)
   Baud Rate: 300 to 38.4 k
   Data Format: 7/8 bits; odd, even, or no parity

6. MEMORY:
   Nonvolatile E²PROM retains all programming parameters and count values when power is removed.

7. OUTPUT:
   Relay: Form C contacts rated at 5 amps @ 120/240 V AC or 28 VDC (resistive load), 1/8 H.P. @ 120 V AC (inductive load)

8. ENVIRONMENTAL CONDITIONS:
   Operating temperature: 0 to 50 °C
   Storage temperature: -40 to 70 °C
   Operating and storage humidity: 0 to 85% max. RH (non-condensing)
   Altitude: Up to 2,000 meters

9. CONNECTIONS:
   Internal removable terminal blocks
   Wire Strip Length: 0.4" (10 mm)
   Wire Gage: 24-12 AWG copper wire
   Torque: 5.3 inch-lbs (0.6 N-m) max.

10. CERTIFICATIONS AND COMPLIANCES:
    SAFETY
    IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
    IP65 Enclosure rating (Face only), IEC 529
    Type 4X Enclosure rating (Face only), UL50
    ELECTROMAGNETIC COMPATIBILITY
    Emissions and Immunity to EN 61326: Electrical Equipment for Measurement, Control and Laboratory use.
    Immunity to Industrial Locations:
    Electrostatic discharge EN 61000-4-2 Criterion B
    Electromagnetic RF fields EN 61000-4-3 Criterion B
    Fast transients (burst) EN 61000-4-4 Criterion B
    Surge EN 61000-4-5 Criterion A
    RF conducted interference EN 61000-4-6 Criterion B
    Voltage dip/interruptions EN 61000-4-11 Criterion A
    Emissions:
    Emissions EN 55011 Class A
    Notes:
    2. Criterion B: Temporary loss of performance from which the unit self-recovers.

11. CONSTRUCTION:
    Aluminum enclosure, and steel side panels with textured black polyurethane paint for scratch and corrosion resistance protection. Sealed front panel meets NEMA 4X/IP65 specifications. Installation Category II, Pollution Degree 2.

12. WEIGHT:
    LD2A05XX - 4.5 lbs (2.04 kg)
    LD4A05XX - 10.5 lbs (4.76 kg)

1.0 INSTALLING THE METER

INSTALLATION
The meter meets NEMA 4X/IP65 requirements when properly installed.

INSTALLATION ENVIRONMENT
The unit should be installed in a location that does not exceed the operating temperature. Placing the unit near devices that generate excessive heat should be avoided.

The unit should only be cleaned with a soft cloth and neutral soap product. Do NOT use solvents.

Continuous exposure to direct sunlight may accelerate the aging process of the front overlay. Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

2.0 SETTING THE JUMPERS

INPUT RANGE JUMPER
This jumper is used to select the proper input range. The input range selected in programming must match the jumper setting. Select a range that is high enough to accommodate the maximum signal input to avoid overloads. To access the jumper, remove the side cover of the meter.

Warning: Exposed line voltage exists on the circuit boards. Remove all power to the meter and load circuits before accessing inside of the meter.
3.0 WIRING THE METER

EMC INSTALLATION GUIDELINES

Although this meter is designed with a high degree of immunity to Electro-Magnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the meter may be different for various installations. The meter becomes more immune to EMI with fewer I/O connections. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. The meter should be properly connected to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the meter and leave the other end of the shield unconnected and insulated from earth ground.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far as possible from contactors, control relays, transformers, and other noisy components.
5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   Ferrite Suppression Cores for signal and control cables:
   Fair-Rite # 0443167251 (RLC# FCOR0000)
   TDK # ZCAT3035-1330A
   Steward # 28B2029-0A0
   Line Filters for input power cables:
   Schaffner # FN610-1/07 (RLC# LFIL0000)
   Schaffner # FN670-1.8/07
   Corcom # 1 VR3
   Note: Reference manufacturer's instructions when installing a line filter.
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   Snubber: RLC# SNUB0000.

WIRING OVERVIEW

Electrical connections are made via pluggable terminal blocks located inside the meter. All conductors should conform to the meter’s voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that the power supplied to the meter (DC or AC) be protected by a fuse or circuit breaker. When wiring the meter, compare the numbers on the label on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.4” (10 mm) bare lead exposed (stranded wires should be tinned with solder.) Insert the lead under the correct screw clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.) Each terminal can accept up to one #14 AWG (2.55 mm) wire, two #18 AWG (1.02 mm), or four #20 AWG (0.61 mm).

WIRING CONNECTIONS

Internal removable terminal blocks are used for power and signal wiring. Remove end plates with ¼” nut driver. For LD4 versions, all wiring is on the right side of unit. For LD2 versions, power and relay wiring is on the right side and the input, serial, DC out and user input is on the left side.

3.1 POWER WIRING

The power wiring is made via the 3 position terminal block (TBA) located inside the unit (right side). The DC out power is located: LD2 - left side, LD4 - right side.

**Power**

Terminal 1: VAC/DC +
Terminal 2: VAC/DC -
Terminal 3: Earth Ground

**DC Out Power**

Terminal 4: + 24 VDC OUT
Terminal 6: User Common

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**Diagram**

[Diagram showing LD2 and LD4 wiring connections]
3.2 USER INPUT WIRING

The User Input is located: LD2 - left side, LD4 - right side

Terminal 5: User Input
Terminal 6: User Comm

3.3 SETPOINT (OUTPUT) WIRING

The setpoint relays use a six position terminal block (TBB) located inside the (right side).

Terminal 1: NC 1
Terminal 2: NO 2
Terminal 3: Relay 1 Common
Terminal 4: NC 1
Terminal 5: NO 2
Terminal 6: Relay 2 Common

3.4 INPUT WIRING

The Large Display has two signal inputs, Volt and Current. These inputs are wired to terminal block TBC located inside the unit on the left side (LD2) and on the right side (LD4).

Voltage Signal (self powered)
Terminal 1: +VDC
Terminal 2: -VDC

Current Signal (self powered)
Terminal 3: +ADC
Terminal 2: -ADC

Current Signal (2 wire requiring excitation)
Terminal 4: +EXC
Terminal 3: +ADC

Current Signal (3 wire requiring excitation)
Terminal 3: +ADC (signal)
Terminal 2: -ADC (common)
Terminal 4: +EXC

Voltage Signal (3 wire requiring excitation)
Terminal 1: +VDC (signal)
Terminal 2: -VDC (common)
Terminal 4: +EXC

CAUTION: Analog common is NOT isolated from user input common. In order to preserve the safety of the meter application, the DC common must be suitably isolated from hazardous live earth referenced voltage; or input common must be at protective earth ground potential. If not, hazardous voltage may be present at the User Input and Input Common terminals. Appropriate considerations must then be given to the potential of the input common with respect to earth ground. Always connect the analog signal common to terminal 2.

Before connecting signal wires, the Input Range Jumper should be verified for proper position.

3.5 INPUT SIGNAL WIRING
3.6 SERIAL WIRING

The serial connections are made via terminal block TBD located inside the unit on the left side for the LD2 and on the right side for the LD4.

RS232 Communications

RS232 is intended to allow two devices to communicate over distances up to 50 feet. Data Terminal Equipment (DTE) transmits data on the Transmitted Data (TXD) line and receives data on the Received Data (RXD) line. Data Computer Equipment (DCE) receives data on the TXD line and transmits data on the RXD line. The LD emulates a DTE. If the other device connected to the meter also emulates a DTE, the TXD and RXD lines must be interchanged for communications to take place. This is known as a null modem connection. Most printers emulate a DCE device while most computers emulate a DTE device. Some devices cannot accept more than two or three characters in succession without a pause in between. In these cases, the meter employs a busy function. As the meter begins to transmit data, the RXD line (RS232) is monitored to determine if the receiving device is “busy”. The receiving device asserts that it is busy by setting the RXD line to a space condition (logic 0). The meter then suspends transmission until the RXD line is released by the receiving device.

RS485 Communications

The RS485 communication standard allows the connection of up to 32 devices on a single pair of wires, distances up to 4,000 ft. and data rates as high as 10M baud (the LDA is limited to 38.4k baud). The same pair of wires is used to both transmit and receive data. RS485 is therefore always half-duplex, that is, data cannot be received and transmitted simultaneously.

4.0 REVIEWING THE FRONT BUTTONS AND DISPLAY

Pressing the SEL button toggles the meter through the selected displays. If display scroll is enabled, the display will toggle automatically every four seconds between the enabled display values.

OPERATING MODE DISPLAY DESIGNATORS

MAX - Maximum display capture value
MIN - Minimum display capture value

*1, 2* - To the left of the display indicates setpoint 1, 2 output activated.

<table>
<thead>
<tr>
<th>BUTTON</th>
<th>DISPLAY MODE OPERATION</th>
<th>PROGRAMMING MODE OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAR</td>
<td>Access Programming Mode</td>
<td>Store selected parameter and index to next parameter</td>
</tr>
<tr>
<td>SEL</td>
<td>Index display through selected displays</td>
<td>Advance through selection list/select digit position in parameter value</td>
</tr>
<tr>
<td>RST</td>
<td>Resets display</td>
<td>Increment selected digit of parameter value</td>
</tr>
</tbody>
</table>

*1, 2* - To the left of the display indicates setpoint 1, 2 output activated.
5.0 Programming the Meter

**Overview**

**Programming Menu**

- **Program Mode Entry (PAR Button)**
  It is recommended all programming changes be made off line, or before installation. The meter normally operates in the Display Mode. No parameters can be programmed in this mode. The Programming Mode is entered by pressing the PAR button. If it is not accessible, then it is locked by either a security code or a hardware lock.

- **Module Entry (SEL ▲ & PAR Buttons)**
  The Programming Menu is organized into five modules. These modules group together parameters that are related in function. The display will alternate between Pro and the present module. The SEL ▲ button is used to select the desired module. The displayed module is entered by pressing the PAR button.

- **Module Menu (PAR Button)**
  Each module has a separate module menu (which is shown at the start of each module discussion). The PAR button is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters. After completing a module, the display will return to Pro NO. Programming may continue by accessing additional modules.

- **Selection / Value Entry**
  For each parameter, the display alternates between the present parameter and the selections/value for that parameter. The SEL ▲ and RST ▼ buttons are used to move through the selections/values for that parameter. Pressing the PAR button, stores and activates the displayed selection/value. This also advances the meter to the next parameter.

  For numeric values, the value is displayed with one digit flashing (initially the right most digit). Pressing the RST ▼ button increments the digit by one or the user can hold the RST ▼ button and the digit will automatically scroll. The SEL ▲ button will select the next digit to the left. Pressing the PAR button will enter the value and move to the next parameter.

- **Programming Mode Exit (PAR Button)**
  The Programming Mode is exited by pressing the PAR button with Pro NO displayed. This will commit any stored parameter changes to memory and return the meter to the Display Mode. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)

- **Programming Tips**
  It is recommended to start with Module 1 and proceed through each module in sequence. When programming is complete, it is recommended to record the parameter programming and lock out parameter programming with the user input or programming security code.

- **Factory Settings**
  Factory Settings may be completely restored in Module 2. This is useful when encountering programming problems.

  Pressing both the SEL and the RST button on power-up will also load the factory settings and display rESP. This allows operation in the event of a memory failure or corrupted data.

- **Alternating Selection Display**
  In the explanation of the modules, the following dual display with arrows will appear. This is used to illustrate the display alternating between the parameter on top and the parameter’s Factory Setting on the bottom. In most cases, selections and values for the parameter will be listed on the right.

### 5.1 Module 1 - Signal Input Parameters (1-INP)

**Parameter Menu**

#### Input Range

- **Selection**: 200uA, 20.00 mA, 200.00 mA, 20.000 mA, 200.00 V, 2.0000 V, 200.00 mA, 20.000 V, 200.00 V, 10.000 V

Select the input range that corresponds to the external signal. This selection should be high enough to avoid input signal overload but low enough for the desired input resolution. This selection and the position of the Input Range Jumper must match.

#### Display Decimal Point

- **Selection**: Choose from 0.0000 to 9.9999

Select the decimal point location for the Input, MIN and MAX displays. This selection also affects the \$P_1 and \$P_2 parameters and setpoint values and offset value.

#### Display Offset Value

- **Range**: -19999 to 19999

The display can be corrected with an offset value. This can be used to compensate for signal variations or sensor errors. This value is automatically...
updated after a Zero Display to show how far the display is offset. A value of zero will remove the effects of offset. The decimal point follows the δELP selection.

**FILTER SETTING**

If the displayed value is difficult to read due to small process variations or noise, increased levels of filtering will help to stabilize the display. Software filtering effectively combines a fraction of the current input reading with a fraction of the previously displayed reading to generate the new display. Filter values represent no filtering (0), up to heavy filtering (3). A value of 1 for the filter uses 1/4 of the new input and 3/4 of the previous display to generate the new display. A filter value of 2 uses 1/8 new and 7/8 previous. A filter value of 3 uses 1/16 new and 15/16 previous.

**FILTER BAND**

The filter will adapt to variations in the input signal. When the variation exceeds the input filter band value, the filter disengages. When the variation becomes less than the band value, the filter engages again. This allows for a stable readout, but permits the display to settle rapidly after a large process change. The value of the band is in display units, independent of the Display Decimal Point position. A band setting of ‘0’ keeps the filter permanently engaged at the filter level selected above.

**SCALING STYLE**

If Input Values and corresponding Display Values are known, the Key-in (KEY) scaling style can be used. This allows scaling without the presence or changing of the input signal. If Input Values have to be derived from the actual input signal source or simulator, the Apply (APLY) scaling style must be used.

**INPUT VALUE FOR SCALING POINT 1**

For Key-in (KEY) style, enter the first Input Value using the front panel buttons. (The Input Range selection sets the decimal location for the Input Value). For Apply (APLY) style, the meter shows the previously stored Input Value. To retain this value, press the SEL button to advance to the next parameter. To change the Input Value, press the RST button and apply the input signal to the meter. Adjust the signal source externally until the desired Input Value appears. Press the SEL button to enter the value being displayed.

**DISPLAY VALUE FOR SCALING POINT 1**

Enter the first Display Value by using the front panel buttons. This is the same for KEY and APLY scaling styles. The decimal point follows the δELP selection.

**INPUT VALUE FOR SCALING POINT 2**

For Key-in (KEY) style, enter the known second Input Value using the front panel buttons. For Apply (APLY) style, the meter shows the previously stored Input Value for Scaling Point 2. To retain this value, press the SEL button to advance to the next parameter. To change the Input Value, press the RST button and apply the input signal to the meter. Adjust the signal source externally until the desired Input Value appears. Press the SEL button to enter the value being displayed.

**DISPLAY VALUE FOR SCALING POINT 2**

Enter the second Display Value by using the front panel buttons. This is the same for KEY and APLY scaling styles. The decimal point follows the δELP selection.

**General Notes on Scaling**

1. When using the Apply (APLY) scaling style, input values for scaling points must be confined to the range limits shown.
2. The same Input Value should not correspond to more than one Display Value. (Example: 20 mA can not equal 0 and 20.)
3. For input levels beyond the programmed Input Values, the meter extends the Display Value by calculating the slope from the two coordinate pairs (INP1 / dSP1 and INP2 / dSP2).

**USER INPUT FUNCTION**

**USER INPUT ASSIGNMENT**

Select the value(s) to which the User Input Function is assigned. The User Input Assignment only applies if a selection of reset, display hold, or print and reset is selected in the User Input Function menu.

**USER INPUT ACTIVE LEVEL**

Select whether the user input is configured as active low or active high.
5.2 MODULE 2 - SECONDARY FUNCTION PARAMETERS (2-SEC)

**MAX DISPLAY ENABLE**

Enables the Maximum Display Capture capability.

**MAX CAPTURE DELAY TIME**

When the Input Display is above the present MAX value for the entered delay time, the meter will capture that display value as the new MAX reading. A delay time helps to avoid false captures of sudden short spikes.

**MIN DISPLAY ENABLE**

Enables the Minimum Display Capture capability.

**MIN CAPTURE DELAY TIME**

When the Input Display is below the present MIN value for the entered delay time, the meter will capture that display value as the new MIN reading. A delay time helps to avoid false captures of sudden short spikes.

**FACTORY SERVICE OPERATIONS**

Select YES to perform either of the Factory Service Operations shown below.

**RESTORE FACTORY DEFAULT SETTINGS**

Entering Code 66 will overwrite all user settings with the factory settings. The meter will display rESet and then return to Code 00. Press the PAR button to exit the module.

Pressing both the SEL and the RST buttons on power-up will also load the factory settings and display rESet. This allows operation in the event of a memory failure or corrupted data.

**VIEW MODEL AND VERSION DISPLAY**

Entering Code 50 will display the model (LDA) and version (x.x) of the meter. The display then returns to Code 00. Press the PAR button to exit the module.

---

**CALIBRATION**

The LD uses stored calibration values to provide accurate measurements. Over time, the electrical characteristics of the components inside the LD will slowly change with the result that the stored calibration values no longer accurately define the input circuit. For most applications, recalibration every 1 to 2 years should be sufficient.

Calibration of the LD involves a calibration which should only be performed by individuals experienced in calibrating electronic equipment. Allow 30 minute warm up before performing any calibration related procedure. The following procedures should be performed at an ambient temperature of 15 to 35 °C (59 to 95 °F).

**Current Calibration**

1. Connect the negative lead of a precision DC current source with an accuracy of 0.01% or better to the COMM terminal. Leave the positive lead of the DC current source unconnected.
2. With the display at Code 48, press the PAR button. Unit will display CAL  NO.
3. Press the RST button to select the range to be calibrated.
4. Press the PAR button. Display reads 0.0A.
5. With the positive lead of the DC current source unconnected, press PAR. Display reads CALC for about 8 seconds.
6. When the display reads the selected range, connect the positive lead of the DC current source to the current input and apply full-scale input signal for the range. (Note: For 200 mA range, apply 100 mA as indicated on the display.) Press PAR. Display reads CALC for about 8 seconds.
7. Repeat steps 3 through 6 for each input range to be calibrated. When display reads CAL NO, press the PAR button to exit calibration.

**Voltage Calibration**

1. Connect a precision DC voltage source with an accuracy of 0.01% or better to the volt input and COMM terminals of the LD. Set the output of the voltage source to zero.
2. With the display at Code 48, press the PAR button. Unit will display CAL  NO.
3. Press the RST button to select the range to be calibrated.
4. Press the PAR button. Display reads 0.0v.
5. With the voltage source set to zero (or a dead short applied to the input), press PAR. Display reads CALC for about 8 seconds.
6. When the display reads the selected range, apply full-scale input signal for the range. (Note: For 200V range, apply 100V as indicated on the display.) Press PAR. Display reads CALC for about 8 seconds.
7. Repeat steps 3 through 6 for each input range to be calibrated. When display reads CAL NO, press the PAR button to exit calibration.
5.3 MODULE 3 - DISPLAY AND FRONT PANEL BUTTON PARAMETERS (3-dSP)

**DISPLAY UPDATE TIME**

[3-dSP]  
³ dSP-t

Display Update Time

This parameter sets the display update time in seconds.

**FRONT PANEL DISPLAY SELECT ENABLE (SEL)**

[SEl]  
³ yES  NO

The YES selection allows the SEL button to toggle through the enabled displays.

**FRONT PANEL RESET ENABLE (RST)**

[rSt]  
³ NO  fD  HI-LO  dSP

This selection allows the RST button to reset the selected value(s).

**ZERO DISPLAY WITH DISPLAY RESET**

[2ERd]  
³ NO  yES  NO

This parameter enables the RST button or user input to zero the input display value, causing the display reading to be offset.

Note: For this parameter to operate, the RST button or User Input being used must be set to dSP and the Input value must be displayed. If these conditions are not met, the display will not zero.

**DISPLAY SCROLL ENABLE**

[Scrol]  
³ NO  yES  NO

The YES selection allows the display to automatically scroll through the enabled displays. The scroll rate is every 4 seconds. This parameter only appears when the MAX or MIN displays are enabled.

**DISPLAY INTENSITY LEVEL**

[d-LEU]  
³ 1 5

Enter the desired Display Intensity Level (1-5). The display will actively dim or brighten as levels are changed.

**PROGRAMMING SECURITY CODE**

[CoDE]  
³ 000 to 999

The Security Code determines the programming mode and the accessibility of programming parameters. This code can be used along with the Program Mode Lock-out (P-Loc) in the User Input Function parameter (Module 1).

Two programming modes are available. Full Programming mode allows all parameters to be viewed and modified. Quick Programming mode permits only the Setpoint values to be modified, but allows direct access to these values without having to enter Full Programming mode.

Programming a Security Code other than 0, requires this code to be entered at the CoDE prompt in order to access Full Programming mode. Depending on the code value, Quick Programming may be accessible before the CoDE prompt appears (see chart).

<table>
<thead>
<tr>
<th>USER INPUT FUNCTION</th>
<th>USER INPUT STATE</th>
<th>SECURITY CODE</th>
<th>MODE WHEN &quot;SEl&quot; BUTTON IS PRESSED</th>
<th>FULL PROGRAMMING MODE ACCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not P-Loc</td>
<td></td>
<td>0</td>
<td>Full Programming</td>
<td>Immediate Access</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-99</td>
<td>Quick Programming</td>
<td>After Quick Programming</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100-999</td>
<td>CoDE prompt</td>
<td>With correct code entry</td>
</tr>
<tr>
<td>P-Loc</td>
<td>Active</td>
<td>0</td>
<td>Programming Lock</td>
<td>No Access</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-99</td>
<td>Quick Programming</td>
<td>No Access</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100-999</td>
<td>CoDE prompt</td>
<td>With correct code entry</td>
</tr>
<tr>
<td>Not Active</td>
<td>0-999</td>
<td>Full Programming</td>
<td>Immediate Access</td>
<td></td>
</tr>
</tbody>
</table>
5.4 MODULE 4 - SETPOINT OUTPUT PARAMETERS (4-SPt)

PARAMETER MENU

SETPOINT SELECT

SPSEL

Enter the setpoint (output) to be programmed. The \( n \) in the following parameters will reflect the chosen setpoint number. After the chosen setpoint is completely programmed, the display will return to SPSEL. Repeat steps for each setpoint to be programmed. Select NO to exit the module.

SETPOINT ENABLE

Enb-n

Select YES to enable Setpoint \( n \) and access the setup parameters. If NO is selected, the unit returns to SPSEL and Setpoint \( n \) is disabled.

SETPOINT ACTION

RcL-n

Enter the action for the selected setpoint (output). See Setpoint Output Figures for a visual detail of each action.

- HI-bL = High Acting, with balanced hysteresis
- LO-bL = Low Acting, with balanced hysteresis
- HI-Ub = High Acting, with unbalanced hysteresis
- LO-Ub = Low Acting, with unbalanced hysteresis

SETPOINT VALUE

SPt-n

Enter the desired setpoint value. The decimal point position for the setpoint and hysteresis values follow the selection set in Module 1.

HYSTERESIS VALUE

HYS-n

Enter desired hysteresis value. See Setpoint Output Figures for visual explanation of how setpoint output actions (balanced and unbalanced) are affected by the hysteresis. When the setpoint is a control output, usually balanced hysteresis is used. For alarm applications, usually unbalanced hysteresis is used. For unbalanced hysteresis modes, the hysteresis functions on the low side for high acting setpoints and functions on the high side for low acting setpoints.

Note: Hysteresis eliminates output chatter at the switch point, while time delay can be used to prevent false triggering during process transient events.

ON TIME DELAY

OM-n

Enter the time value in seconds that the output is delayed from turning on after the trigger point is reached. A value of 0.0 allows the meter to update the output status per the response time listed in the Specifications.

OFF TIME DELAY

OF-n

Enter the time value in seconds that the output is delayed from turning off after the trigger point is reached. A value of 0.0 allows the meter to update the output status per the response time listed in the Specifications.

OUTPUT RESET ACTION

rSt-n

Enter the reset action of the output. See figure for details.

- Auto = Automatic action; This action allows the output to automatically reset off at the trigger points per the Setpoint Action shown in Setpoint Output Figures. The “on” output may be manually reset (off) immediately by the front panel RST button or user input. The output remains off until the trigger point is crossed again.
- Latch = Latch with immediate reset action; This action latches the output on at the trigger point per the Setpoint Action shown in Setpoint Output Figures. Latch means that the output can only be turned off by the front panel RST button or user input manual reset, serial reset command or meter power cycle. When the user input or RST button is activated (momentary action), the
corresponding "on" output is reset immediately and remains off until the trigger point is crossed again. (Previously latched alarms will be off if power up Display Value is lower than setpoint value.)

L-dLY = Latch with delay reset action; This action latches the output on at the trigger point per the Setpoint Action shown in Setpoint Output Figures. Latch means that the output can only be turned off by the front panel RST button or user input manual reset, serial reset command or meter power cycle. When the user input or RST button is activated (momentary action), the meter delays the event until the corresponding "on" output crosses the trigger off point. (Previously latched outputs are off if power up Display Value is lower than setpoint value. During a power cycle, the meter erases a previous L-dLY reset if it is not activated at power up.)

OUTPUT RESET WITH DISPLAY RESET

This parameter enables the RST button or User Input to reset the output when the display is reset.

Note: For this parameter to operate, the RST button or User Input being used must be set to dSP and the Input value must be displayed. If these conditions are not met, the output will not reset.

STANDBY OPERATION

When YES, the output is disabled (after a power up) until the trigger point is crossed. Once the output is on, the output operates normally per the Setpoint Action and Output Reset Action.

5.5 MODULE 5 - SERIAL SETUP PARAMETERS (5-SEr)

Module 5 is the programming module for the Serial Communications Parameters. These parameters are used to match the serial settings of the LD with those of the host computer or other serial device.

**BAUD RATE**

Set the baud rate to match that of other serial communications equipment. Normally, the baud rate is set to the highest value that all of the serial communications equipment is capable of transmitting and receiving.

**DATA BIT**

Select either 7- or 8-bit data word length. Set the word length to match the other serial communications equipment on the serial link.

**PARITY BIT**

This parameter only appears when the Data Bit parameter is set to a 7-bit data word length. Set the parity bit to match that of the other serial equipment on the serial link. The meter ignores parity when receiving data and sets the parity bit for outgoing data. If parity is set to NO, an additional stop bit is used to force the frame size to 10 bits.
Sending Serial Commands and Data

When sending commands to the meter, a string containing at least one command character must be constructed. A command string consists of a command character, a value identifier, numerical data (if writing data to the meter) followed by a command terminator character, * or $.

Command Chart

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Node (meter) Address Specifier</td>
<td>Address a specific meter. Must be followed by one or two digit node address. Not required when node address = 0.</td>
</tr>
<tr>
<td>T</td>
<td>Transmit Value (read)</td>
<td>Read a register from the meter. Must be followed by a register ID character.</td>
</tr>
<tr>
<td>V</td>
<td>Value Change (write)</td>
<td>Write to register of the meter. Must be followed by a register ID character and numeric data.</td>
</tr>
<tr>
<td>R</td>
<td>Reset</td>
<td>Reset a min or max value or the output. Must be followed by a register ID character.</td>
</tr>
<tr>
<td>P</td>
<td>Block Print Request (read)</td>
<td>Initiates a block print output. Registers in the print block are selected in Print Options.</td>
</tr>
</tbody>
</table>

Command String Construction

The command string must be constructed in a specific sequence. The meter does not respond with an error message to illegal commands. The following procedure details construction of a command string:

1. The first 2 or 3 characters consist of the Node Address Specifier (N) followed by a 1 or 2 character node address number. The node address number of the meter is programmable. If the node address is 0, this command and the node address itself may be omitted. This is the only command that may be used in conjunction with other commands.
2. After the optional address specifier, the next character is the command character.
3. The next character is the register ID. This identifies the register that the command affects. The P command does not require a register ID character. It prints all the active selections chosen in the Print Options menu parameter.
4. If constructing a value change command (writing data), the numeric data is sent next.
5. All command strings must be terminated with the string termination characters * or $. The meter does not begin processing the command string until this character is received. See timing diagram figure

Register Identification Chart

<table>
<thead>
<tr>
<th>ID</th>
<th>Value Description</th>
<th>MNEMONIC</th>
<th>Applicable Commands</th>
<th>Transmit Details (T and V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Input</td>
<td>INP</td>
<td>T, R</td>
<td>5 digit</td>
</tr>
<tr>
<td>B</td>
<td>Maximum</td>
<td>MAX</td>
<td>T, R</td>
<td>5 digit</td>
</tr>
<tr>
<td>C</td>
<td>Minimum</td>
<td>MIN</td>
<td>T, R</td>
<td>5 digit</td>
</tr>
<tr>
<td>D</td>
<td>Setpoint 1</td>
<td>SP1</td>
<td>T, R, V</td>
<td>5 digit positive/4 digit negative</td>
</tr>
<tr>
<td>E</td>
<td>Setpoint 2</td>
<td>SP2</td>
<td>T, R, V</td>
<td>5 digit positive/4 digit negative</td>
</tr>
</tbody>
</table>

Command String Examples:
1. Node address = 17, Write 350 to the Setpoint 1 value
   String: N17VD350$  
2. Node address = 5, Read Input, response time of 50 msec min
   String: N5TA*  
3. Node address = 31, Request a Block Print Output, response time of 2 msec min
   String: N31PS

Transmitting Data to the Meter

Numeric data sent to the meter must be limited to transmit details listed in the Register Identification Chart. Leading zeros are ignored. Negative numbers must have a minus sign. The meter ignores any decimal point and conforms the number to the scaled resolution. (For example: The meter’s scaled decimal point position is set for 0.0 and 25 is written to a register. The value of the register is now 2.5. In this case, write a value of 250 to equal 25.0.)

Note: Since the meter does not issue a reply to value change commands, follow with a transmit value command for readback verification.
Receiving Data From The Meter

Data is transmitted from the meter in response to either a transmit command (T), a block print request command (P) or a User Input print request. The response from the meter is either a full field transmission or an abbreviated transmission, depending on the selection chosen in Module 5.

Full Field Transmission

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2</td>
<td>2 byte Node Address field [00-99]</td>
</tr>
<tr>
<td>3</td>
<td>&lt;SP&gt; (Space)</td>
</tr>
<tr>
<td>4-6</td>
<td>3 byte Register Mnemonic field</td>
</tr>
<tr>
<td>7-15</td>
<td>9 byte data field; 7 bytes for number, one byte for sign, one byte for decimal point</td>
</tr>
<tr>
<td>16</td>
<td>&lt;CR&gt; (carriage return)</td>
</tr>
<tr>
<td>17</td>
<td>&lt;LF&gt; (line feed)</td>
</tr>
<tr>
<td>18</td>
<td>&lt;SP&gt; (Space)</td>
</tr>
<tr>
<td>19</td>
<td>&lt;CR&gt;* (carriage return)</td>
</tr>
<tr>
<td>20</td>
<td>&lt;LF&gt;* (line feed)</td>
</tr>
</tbody>
</table>

* These characters only appear in the last line of a block print.

The first two characters transmitted are the meter address. If the address assigned is 0, two spaces are substituted. A space follows the meter address field. The next three characters are the register mnemonic, as shown in the Register Identification Chart.

The numeric data is transmitted next. The numeric field (bytes 7 to 18) is 12 characters long. When a requested counter or rate value exceeds the meter’s display limits, an * (used as an overflow character) replaces a space in byte 7. Byte 8 is always a space.

The remaining ten positions of this field consist of a minus sign (for negative values), a floating decimal point (if applicable), and eight positions for the requested value. The data within bytes 9 to 18 is right-aligned with leading spaces for any unfilled positions.

The end of the response string is terminated with a <CR> and <LF>. After the last line of a block print, an extra <SP>, <CR> and <LF> are added to provide separation between the print blocks.

Abbreviated Transmission

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-9</td>
<td>9 byte data field, 7 bytes for number, one byte for sign, one byte for decimal point</td>
</tr>
<tr>
<td>10</td>
<td>&lt;CR&gt; (carriage return)</td>
</tr>
<tr>
<td>11</td>
<td>&lt;LF&gt; (line feed)</td>
</tr>
<tr>
<td>12</td>
<td>&lt;SP&gt; (Space)</td>
</tr>
<tr>
<td>13</td>
<td>&lt;CR&gt; (carriage return)</td>
</tr>
<tr>
<td>14</td>
<td>&lt;LF&gt; (line feed)</td>
</tr>
</tbody>
</table>

* These characters only appear in the last line of a block print.

The abbreviated response suppresses the node address and register ID, leaving only the numeric part of the response.

Meter Response Examples:

1. Node address = 17, full field response, Input = 875
   17 INP 875 <CR><LF>

2. Node address = 0, full field response, Setpoint 1 = -250.5
   SP1 -250.5<CR><LF>

3. Node address = 0, abbreviated response, Setpoint 2 = 250, last line of block print
   250<CR><LF><SP><CR><LF>

Command Response Time

The meter can only receive data or transmit data at any one time (half-duplex operation). During RS232 transmissions, the meter ignores commands while transmitting data, but instead uses RXD as a busy signal. When sending commands and data to the meter, a delay must be imposed before sending another command. This allows enough time for the meter to process the command and prepare for the next command.

At the start of the time interval t1, the computer program prints or writes the string to the com port, thus initiating a transmission. During t1, the command characters are under transmission and at the end of this period, the command terminating character (*) or ($) is received by the meter. The time duration of t1 is dependent on the number of characters and baud rate of the channel.

\[
t_1 = \frac{10 \times \text{# of characters}}{\text{baud rate}}
\]

At the start of time interval t2, the meter starts the interpretation of the command and when complete, performs the command function. This time interval t2 varies. If no response from the meter is expected, the meter is ready to accept another command.

If the meter is to reply with data, the time interval t2 is controlled by the use of the command terminating character. The ** terminating character results in a response time of 50 msec. minimum. This allows sufficient time for the release of the sending driver on the RS485 bus. Terminating the command line with ‘$’ results in a response time (t3) of 2 msec. minimum. The faster response time of this terminating character requires that sending drivers release within 2 msec. after the terminating character is received.

At the beginning of time interval t3, the meter responds with the first character of the reply. As with t1, the time duration of t3 is dependent on the number of characters and baud rate of the channel. At the end of t3, the meter is ready to receive the next command.

\[
t_3 = \frac{10 \times \text{# of characters}}{\text{baud rate}}
\]

The maximum serial throughput of the meter is limited to the sum of the times t1, t2 and t3.
**Communication Format**

Data is transferred from the meter through a serial communication channel. In serial communications, the voltage is switched between a high and low level at a predetermined rate (baud rate) using ASCII encoding. The receiving device reads the voltage levels at the same intervals and then translates the switched levels back to a character. The voltage level conventions depend on the interface standard. The table lists the voltage levels for each standard.

<table>
<thead>
<tr>
<th>LOGIC</th>
<th>INTERFACE STATE</th>
<th>RS232*</th>
<th>RS485*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>mark (idle)</td>
<td>TXD,RXD; -3 to -15 V</td>
<td>a-b &lt; -200 mV</td>
</tr>
<tr>
<td>0</td>
<td>space (active)</td>
<td>TXD,RXD; +3 to +15 V</td>
<td>a-b &gt; +200 mV</td>
</tr>
</tbody>
</table>

* Voltage levels at the Receiver

Data is transmitted one byte at a time with a variable idle period between characters (0 to ∞). Each ASCII character is “framed” with a beginning start bit, an optional parity bit and one or more ending stop bits. The data format and baud rate must match that of other equipment in order for communication to take place. The figures list the data formats employed by the meter.

**Start Bit and Data Bits**

Data transmission always begins with the start bit. The start bit signals the receiving device to prepare for reception of data. One bit period later, the least significant bit of the ASCII encoded character is transmitted, followed by the remaining data bits. The receiving device then reads each bit position as they are transmitted.

**Parity Bit**

After the data bits, the parity bit is sent. The transmitter sets the parity bit to a zero or a one, so that the total number of ones contained in the transmission (including the parity bit) is either even or odd. This bit is used by the receiver to detect errors that may occur to an odd number of bits in the transmission. However, a single parity bit cannot detect errors that may occur to an even number of bits. Given this limitation, the parity bit is often ignored by the receiving device. The meter ignores the parity bit of incoming data and sets the parity bit to odd, even or none (mark parity) for outgoing data.

**Stop Bit**

The last character transmitted is the stop bit. The stop bit provides a single bit period pause to allow the receiver to prepare to re-synchronize to the start of a new transmission (start bit of next byte). The receiver then continuously looks for the occurrence of the start bit. If 7 data bits and no parity is selected, then 2 stop bits are sent from the meter.
Press PAR key to enter Programming Mode.
LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
GENERAL DESCRIPTION

The Large Display is a versatile display that can be configured as a single or dual counter with rate indication, scaling, serial communications and a relay output. There are also basic models that have a single counter with direction control only (no scaling or relay output).

The 4 & 6 digit displays are available in either 2.25" or 4" high red LED digits with adjustable display intensities. The 2.25" high models are readable up to 130 feet. The 4" high models are readable up to 180 feet. All versions are constructed of a NEMA 4X enclosure in light weight aluminum.

The 6-digit programmable models have two signal inputs and a choice of eight different count modes. These include bi-directional, quadrature and anti-coincidence counting, as well as a dual counter mode. When programmed as a dual counter, each counter has separate scaling and decimal point selection.

Rate indication is available on the programmable models only. The rate indicator has separate scaling and decimal point selection, along with programmable display update times. The meter display can be toggled either manually or automatically between the count and rate values.

The programmable models also come with a Form C relay output and jumper selectable RS232 or RS485 serial communications.

SAFETY SUMMARY

All safety regulations, local codes and instructions that appear in this and corresponding literature, or on equipment, must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

SPECIFICATIONS

1. DISPLAY: 2.25" (57 mm) or 4" (101 mm) intensity adjustable Red LED
2. POWER REQUIREMENTS:
   AC POWER:
   AC Input: 85 to 250 V AC 50/60 Hz, 14 V A
   DC Out: 11 to 16 VDC @ 50 mA (consult factory for higher current draw)
   DC POWER:
   DC Input: 11 to 16 VDC @ 400 mA max, 7 W
3. COUNT INPUT(S):
   Counters have DIP switch selectable pull-up (7.8 KΩ) or pull-down resistors (3.9 KΩ) that determine active high or active low input logic. Counters are DIP switch selectable for high or low frequency (Damping capacitor provided for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec min.)
   Input A Trigger levels: VIL = 1.25 V max; VIH = 2.75 V min; VMAX = 28 VDC
   Input B Trigger levels: VIL = 1.0 V max; VIH = 2.4 V min; VMAX = 28 VDC
   Counter Overflow Indication: Display flashes "0000"

LD200400, LD200600, LD400400, & LD400600:
Count Speed: 35 KHz max. @ 50% duty cycle (no scaling)
LD2006P0 & LD4006P0:
Counter A & B Frequency:

<table>
<thead>
<tr>
<th>COUNT MODE</th>
<th>MAX FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNT UD</td>
<td>35K</td>
</tr>
<tr>
<td>RT-CNT</td>
<td>25K</td>
</tr>
<tr>
<td>QUAD X1: QUAD X2</td>
<td>22K</td>
</tr>
<tr>
<td>QUAD X4: DUAL CNT</td>
<td>16K</td>
</tr>
<tr>
<td>ADD/ADD: ADD/SUB</td>
<td>20K</td>
</tr>
</tbody>
</table>

DIMENSIONS In inches (mm)

The protective conductor terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing system.
4. **RATE INPUT**: Models LD2006P0 & LD4006P0 only
   
   Display Range: 0 to 999999
   
   Min Freq.: 0.01 Hz
   
   Max Freq.: See Frequency chart under Count Input specification
   
   Accuracy: ±0.01%
   
   Rate Overflow Indication: Display flashes "SLL"

5. **RESET/USER INPUT**: Function programmable for LD2006P0 & LD4006P0
   
   Reset/User Input: DIP switch selectable pull-up (7.8 KΩ) or pull-down resistor (3.9 KΩ) that determines active high or active low input logic.
   
   Trigger levels: \( V_{IL} = 1.0 \text{ V max} \); \( V_{IH} = 2.4 \text{ V min} \); \( V_{MAX} = 28 \text{ VDC} \)
   
   Response Time: 5 msecs typ.; 100 msecs debounce (activation and release)

6. **COMMUNICATIONS**: (LD2006P0 & LD4006P0 only)
   
   RS485 SERIAL COMMUNICATIONS
   
   Type: RS485 multi-point balanced interface (non-isolated)
   
   Baud Rate: 300 to 19.2 k
   
   Data Format: 7/8 bits; odd, even, or no parity
   
   Bus Address: 0 to 99; max 32 meters per line
   
   RS232 SERIAL COMMUNICATIONS
   
   Type: RS232 half duplex (non-isolated)
   
   Baud Rate: 300 to 19.2 k
   
   Data Format: 7/8 bits; odd, even, or no parity

7. **MEMORY**: Nonvolatile E²PROM retains all programming parameters and count values when power is removed.

8. **OUTPUT**: (LD2006P0 & LD4006P0 only)
   
   Relay: Form C contacts rated at 5 amps @ 120/240 V AC or 28 VDC (resistive load), 1/8 H.P. @ 120 VAC (inductive load)

9. **ENVIRONMENTAL CONDITIONS**:
   
   Operating temperature: 0 to 50 °C
   
   Storage temperature: -40 to 70 °C
   
   Operating and storage humidity: 0 to 85% max. RH (non-condensing)
   
   Altitude: Up to 2,000 meters

10. **CONNECTIONS**: Internal removable terminal blocks are used for power and signal wiring. Remove end plates with ¼" nut driver. For LD4 versions, all wiring is on right side of unit. For LD2 versions, power and signal wiring is on the right side and the optional relay output is on left side.
   
   Wire Strip Length: 0.4" (10 mm)
   
   Wire Gage: 24-12 AWG copper wire
   
   Torque: 5.3 inch-lbs (0.6 N-m) max.

11. **CERTIFICATIONS AND COMPLIANCES**:
   
   **SAFETY**
   
   UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M95
   
   Listed by Und. Lab. Inc. to U.S. and Canadian safety standards
   
   Type 4X Enclosure rating (Face only), UL 50
   
   IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
   
   IP65 Enclosure rating (Face only), IEC 529

   **ELECTROMAGNETIC COMPATIBILITY**
   
   Emissions and Immunity to EN 61326: Electrical Equipment for Measurement, Control and Laboratory use.

   **Immunity to Industrial Locations**:
   
   Electrostrophic discharge
   
   EN 61000-4-2 Criterion A
   
   4 kV contact discharge
   
   8 kV air discharge
   
   Electromagnetic RF fields
   
   EN 61000-4-3 Criterion A
   
   10 V/m
   
   Fast transients (burst)
   
   EN 61000-4-4 Criterion A²
   
   2 kV power
   
   1 kV signal
   
   Surge
   
   EN 61000-4-5 Criterion A²
   
   1 kV L-L,
   
   2 kV L-N-E power
   
   RF conducted interference
   
   EN 61000-4-6 Criterion A
   
   3 V/m

   **Emissions**
   
   EN 55011
   
   Class B

   **Notes**:
   
   
   2. DC Power: Shaffner FN610-1/07 line filter installed on DC power cable to comply.

12. **CONSTRUCTION**
   
   Aluminum enclosure, and steel side panels with textured black polyurethane paint for scratch and corrosion resistance protection. Sealed front panel meets NEMA 4X/IP65 specifications. Installation Category II, Pollution Degree 2.

13. **WEIGHT**
   
   LD2004XX - 3.5 lbs (1.59 kg)
   
   LD2006XX - 4.5 lbs (2.04 kg)
   
   LD4004XX - 8 lbs (3.63 kg)
   
   LD4006XX - 10.5 lbs (4.76 kg)

### ORDERING INFORMATION

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic (No front panel keys)</td>
<td>LD</td>
<td>2.25&quot; High 4-Digit Red LED Counter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LD200400</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.25&quot; High 6-Digit Red LED Counter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LD200600</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4&quot; High 4-Digit Red LED Counter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LD400400</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4&quot; High 6-Digit Red LED Counter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LD400600</td>
</tr>
<tr>
<td>Programmable (With front panel keys)</td>
<td>LD</td>
<td>2.25&quot; High 6-Digit Red LED Count/Rate Indicator w/ Relay Output &amp; RS232/RS485 Serial Communications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LD2006P0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4&quot; High 6-Digit Red LED Count/Rate Indicator w/ Relay Output &amp; RS232/RS485 Serial Communications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LD4006P0</td>
</tr>
</tbody>
</table>

1.0 **INSTALLING THE METER**

**INSTALLATION**

The meter meets NEMA 4X/IP65 requirements when properly installed.

**INSTALLATION ENVIRONMENT**

The unit should be installed in a location that does not exceed the operating temperature. Placing the unit near devices that generate excessive heat should be avoided.

The unit should only be cleaned with a soft cloth and neutral soap product. Do NOT use solvents.

Continuous exposure to direct sunlight may accelerate the aging process of the front overlay. Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.
2.0 Setting the DIP Switches

Setting the 8 DIP Switches

To access the switches, remove the right side plate of the meter. A bank of eight switches is located inside the unit.

Warning: Exposed line voltage exists on the circuit boards. Remove all power to the meter and load circuits before accessing inside of the meter.

Switch 1 (Input A)

Logic: Input A trigger levels \( V_{IL} = 1.25 \text{ V max.} \); \( V_{IH} = 2.75 \text{ V min.} \); \( V_{MAX} = 28 \text{ VDC} \)

Mag: 200 mV peak input sensitivity; 100 mV hysteresis; maximum voltage: 40 V peak (28 Vrms); Must also have SRC switch ON. (Not recommended with counting applications.)

Switch 2 (Input A) [See Note 1]

SNK: Adds internal 7.8 KΩ pull-up resistor to +12VDC, \( I_{MAX} = 2.1 \text{ mA} \).
SRC: Adds internal 3.9 KΩ pull-down resistor, 7.2 mA max. @ 28 VDC max.

Switch 3 (Input A)

High Frequency: Removes damping capacitor and allows max. frequency.
Low Frequency: Adds a damping capacitor for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec.

Switch 4 (Input B) [See Note 1]

SNK: Adds internal 7.8 KΩ pull-up resistor to +12VDC, \( I_{MAX} = 2.1 \text{ mA} \).
SRC: Adds internal 3.9 KΩ pull-down resistor, 7.2 mA max. @ 28 VDC max.

Switch 5 (Input B)

High Frequency: Removes damping capacitor and allows max. frequency.
Low Frequency: Adds a damping capacitor for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec.

Switch 6 (Reset/User Input) [See Note 1]

SNK: Adds internal 7.8 KΩ pull-up resistor to +12VDC, \( I_{MAX} = 2.1 \text{ mA} \).
SRC: Adds internal 3.9 KΩ pull-down resistor, 7.2 mA max. @ 28 VDC max.

Switch 7 (Power Up Reset)

Enable: In this position, the unit resets at power up.
Disable: In this position, the unit does not reset at power up.

Switch 8 (Input B)

Direction Control: In this position Input B is used to control the count direction of Input A when Input A is set to Count with Direction mode (default mode).

Intensity Adjust: In this position Input B is used to adjust the LED intensity. There are five distinct LED levels that can be changed by pulsing Input B. After setting the desired intensity, move switch to OFF position for Direction Control. Units with keypads can program the LED intensity level using Programming Menu 3.

Note 1: When the DIP switch is in the SNK position (OFF), the input is configured as active low. When the switch is in the SRC position (ON), the input is configured as active high.

3.0 Wiring the Meter

EMC Installation Guidelines

Although this meter is designed with a high degree of immunity to Electro-Magnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the meter may be different for various installations. The meter becomes more immune to EMI with fewer I/O connections. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. The meter should be properly connected to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the meter and leave the other end of the shield unconnected and insulated from earth ground.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far as possible from contactors, control relays, transformers, and other noisy components.
5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   - Ferrite Suppression Cores for signal and control cables: Schaffner # FN610-1/07 (RLC# LFIL0000)
   - Schaffner # FN670-1.8/07
   - Steward # 28B2029-0A0
   - Line Filters for input power cables: Fair-Rite # 0443167251 (RLC# FCOR000)
   - TDK # ZCAT3035-130A
   - Steward # 28B2029-0A0
   - Line Filters for input power cables: Schaffner # FN610-1/07 (RLC# LFIL0000)
   - Schaffner # FN670-1.8/07
   - Corcom # 1 VR3
Note: Reference manufacturer’s instructions when installing a line filter.
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI. Snubber: RLC# SNUB0000.

Factory Setting

Input A

LOGIC
SNK
HI FREQ.
LO FREQ.
SRC.
MAG.

Input B

SNK
HI FREQ.
LO FREQ.
SRC.
ENABLE
DISABLE
ON

Intensity Adjust
3.1 POWER WIRING
The power wiring is made via the 5 position terminal block (TBA) located inside unit (right side). **Do not power unit from both AC & DC at the same time.**

**AC Power**
- Terminal 1: VAC
- Terminal 2: VAC
- Terminal 3: Earth Ground
- Terminal 4: +DC Out
- Terminal 5: DC Common

**DC Power**
- Terminal 3: Earth Ground
- Terminal 4: +DC Input
- Terminal 5: DC Common

3.2 USER INPUT WIRING
The Reset/User Input is always Terminal 3 and Input Common is always terminal 4 of (TBB) located inside the unit (right side).

**Sinking Logic**
- Terminal 3: Reset/User Input
- Terminal 4: Input Common

**Sourcing Logic**
- DIP switch 6 OFF

3.3 SETPOINT (OUTPUT) WIRING
The setpoint relay uses a three position terminal block (TBC) located on the left side of LD2006P0 models, and on the right side for LD4006P0 models.

**TBC**
- Terminal 1: NC
- Terminal 2: NO
- Terminal 3: Relay Common
3.4 INPUT WIRING

The Large Display has two signal inputs, A and B. These inputs are wired to terminal block TBB located inside the unit on the right side.

- Terminal 1: Input A
- Terminal 2: Input B
- Terminal 4: Input Common

Programmable models LD2006P0 and LD4006P0 provide a choice of eight different Count Modes. The Count Mode selected determines the action of Inputs A and B. Section 5.1, Input Setup Parameters, provides details on count mode selection and input action.

All other models are non-programmable and provide Count with Direction Mode only. Input A accepts the count signal, while Input B controls the count direction (up/down).

Input B can also be used to adjust the LED display intensity by setting DIP Switch 8 to the ON position (See Section 2.0, Setting the DIP Switches). For programmable models, this only applies in Count with Direction mode.

---

**CAUTION:** DC common is NOT isolated from input common. In order to preserve the safety of the meter application, the DC common must be suitably isolated from hazardous live earth referenced voltage; or input common must be at protective earth ground potential. If not, hazardous voltage may be present at the User Input and Input Common terminals. Appropriate considerations must then be given to the potential of the input common with respect to earth ground.

---

### Magnetic Pickup

- TBA
- DC+ 4
- DC− 5
- INP A 1
- INP B 2
- RESET/USER 3
- INP COMM 4

**Input A**

---

### AC Inputs From Tach Generators, Etc.

- TBA
- DC+ 4
- DC− 5
- INP A 1
- INP B 2
- RESET/USER 3
- INP COMM 4

**Input A**

---

### Two Wire Proximity, Current Source

- TBA
- DC+ 4
- DC− 5
- INP A 1
- INP B 2
- RESET/USER 3
- INP COMM 4

**Input A**

---

### Current Sinking Output

- TBA
- DC+ 4
- DC− 5
- INP A 1
- INP B 2
- RESET/USER 3
- INP COMM 4

**Input A**

---

### Current Sourcing Output

- TBA
- DC+ 4
- DC− 5
- INP A 1
- INP B 2
- RESET/USER 3
- INP COMM 4

**Input A**

---

### Interfacing With TTL

- TBA
- DC+ 4
- DC− 5
- INP A 1
- INP B 2
- RESET/USER 3
- INP COMM 4

**Input A**

---

### Switch or Isolated Transistor; Current Sink

- TBA
- DC+ 4
- DC− 5
- INP A 1
- INP B 2
- RESET/USER 3
- INP COMM 4

**Input A**

---

### Switch or Isolated Transistor; Current Source

- TBA
- DC+ 4
- DC− 5
- INP A 1
- INP B 2
- RESET/USER 3
- INP COMM 4

**Input A**

---

### Current Sink Output; Quad/Direction

- TBA
- DC+ 4
- DC− 5
- INP A 1
- INP B 2
- RESET/USER 3
- INP COMM 4

LD2006P0 and LD4006P0 only.

---

* Switch position is application dependent.

Shaded areas not recommended for counting applications.
3.5 SERIAL WIRING

Serial communications is only available for models LD2006P0 and LD4006P0. From the factory, the unit is defaulted to RS485 communications. If RS232 is desired, both serial jumpers will need changed to the RS232 positions before wiring.

### RS485

- INP A
- INP B
- RESET/USER
- INP COMM
- A (TXD)
- B (RXD)

### RS232

- INP A
- INP B
- RESET/USER
- INP COMM
- A (TXD)
- B (RXD)

#### RS485 Communications

The RS485 communication standard allows the connection of up to 32 devices on a single pair of wires, distances up to 4,000 ft. and data rates as high as 10M baud (the PAX is limited to 19.2k baud). The same pair of wires is used to both transmit and receive data. RS485 is therefore always half-duplex, that is, data cannot be received and transmitted simultaneously.

#### RS232 Communications

RS232 is intended to allow two devices to communicate over distances up to 50 feet. Data Terminal Equipment (DTE) transmits data on the Transmitted Data (TXD) line and receives data on the Received Data (RXD) line. Data Computer Equipment (DCE) receives data on the TXD line and transmits data on the RXD line. The PAX emulates a DTE. If the other device connected to the meter also emulates a DTE, the TXD and RXD lines must be interchanged for communications to take place. This is known as a null modem connection. Most printers emulate a DCE device while most computers emulate a DTE device.

Some devices cannot accept more than two or three characters in succession without a pause in between. In these cases, the meter employs a busy function.

As the meter begins to transmit data, the RXD line (RS232) is monitored to determine if the receiving device is “busy”. The receiving device asserts that it is busy by setting the RXD line to a space condition (logic 0). The meter then suspends transmission until the RXD line is released by the receiving device.

#### 4.0 REVIEWING THE FRONT PANEL KEYS AND DISPLAY

<table>
<thead>
<tr>
<th>KEY</th>
<th>DISPLAY MODE OPERATION</th>
<th>PROGRAMMING MODE OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAR</td>
<td>Access Programming Mode</td>
<td>Store selected parameter and index to next parameter</td>
</tr>
<tr>
<td>SEL</td>
<td>Index display through selected displays</td>
<td>Advance through selection list/increment selected digit of parameter value</td>
</tr>
<tr>
<td>RST</td>
<td>Resets count display</td>
<td>Select digit position in parameter value</td>
</tr>
</tbody>
</table>

Pressing the SEL key toggles the meter through the selected displays. If display scroll is enabled, the display will toggle automatically approximately every four seconds between the rate and count values.
5.0 PROGRAMMING THE METER

OVERVIEW

PROGRAMMING MENU

PROGRAMMING MODE ENTRY (PAR KEY)
It is recommended all programming changes be made off line, or before installation. The meter normally operates in the Display Mode. No parameters can be programmed in this mode. The Programming Mode is entered by pressing the PAR key. If it is not accessible, then it is locked by either a security code or a hardware lock.

MODULE ENTRY (SEL & PAR KEYS)
The Programming Menu is organized into five modules. These modules group together parameters that are related in function. The display will alternate between Pro and the present module. The SEL key is used to select the desired module. The displayed module is entered by pressing the PAR key.

MODULE MENU (PAR KEY)
Each module has a separate module menu (which is shown at the start of each module discussion). The PAR key is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters. After completing a module, the display will return to Pro NO. Programming may continue by accessing additional modules.

SELECTION / VALUE ENTRY
For each parameter, the display alternates between the present parameter and the selections/value for that parameter. The SEL and RST keys are used to move through the selections/values for that parameter. Pressing the PAR key, stores and activates the displayed selection/value. This also advances the meter to the next parameter.

PROGRAMMING TIPS
It is recommended to start with Module 1 for counting or Module 2 for rate. When programming is complete, it is recommended to record the parameter programming and lock out parameter programming with the user input or programming security code.

FACTORY SETTINGS
Factory Settings may be completely restored in Module 3. This is useful when encountering programming problems.

ALTERNATING SELECTION DISPLAY
In the explanation of the modules, the following dual display with arrows will appear. This is used to illustrate the display alternating between the parameter on top and the parameter’s Factory Setting on the bottom. In most cases, selections and values for the parameter will be listed on the right.

5.1 MODULE 1 - INPUT SETUP PARAMETERS (I- IINP)

COUNT MODE
Select the count mode that corresponds with your application. The input actions are shown in the boxes below. For simple counting applications, it is recommended to use Count with Direction for the count mode. Simply leave the direction input unconnected.

Note: The Rate indicator signal is derived from Input A in all count modes.
COUNTER A DECIMAL POSITION

This selects the decimal point position for Counter A and the setpoint value, if assigned to Counter A. The selection will also affect Counter A scale factor calculations.

COUNTER A SCALE FACTOR

The number of input counts is multiplied by the scale factor to obtain the desired process value. A scale factor of 1.0000 will result in the display of the actual number of input counts. (Details on scaling calculations are explained at the end of this section.)*

COUNTER B DECIMAL POSITION

This selects the decimal point position for Counter B. The selection will also affect Counter B scale factor calculations.

COUNTER B SCALE FACTOR

The number of input counts is multiplied by the scale factor to obtain the desired process value. A scale factor of 1.0000 will result in the display of the actual number of input counts. (Details on scaling calculations are explained at the end of this section.)*

COUNTER RESET AT POWER-UP

This selects the position for Counter A and the setpoint value, if assigned to Counter A. The selection will also affect Counter A scale factor calculations.

SCALING FOR COUNT INDICATION

The counter’s scale factor is factory set to 1, to provide one count on the display for each pulse that is input to the unit. In many applications, there will not be a one-to-one correspondence between input pulses and display units. Therefore, it is necessary for the meter to scale or multiply the input pulses by a scale factor to achieve the desired display units (feet, meters, gallons, etc.)

The Count Scale Factor Value can range from 0.0001 to 99.9999. It is important to note that the precision of a counter application cannot be improved by using a scale factor greater than one. To accomplish greater precision, more pulse information must be generated per measuring unit. The following formula is used to calculate the scale factor.

\[
\text{Scale Factor} = \frac{\text{Desired Display Units} \times \text{Decimal Point Position}}{\text{Number of Pulses}}
\]

WHERE:

- Desired Display Units: Count display units acquired after pulses that occurred.
- Number of Pulses: Number of pulses required to achieve the desired display units.

Decimal Point Position:
- 0 = 1
- 0.0 = 10
- 0.00 = 100
- 0.000 = 1000
- 0.0000 = 10000

USER INPUT FUNCTION

The User Input Function is only active if the meter is programmed in the Dual Count Mode and a selection of reset, store, store and reset, inhibit, or print and reset is selected in the User Input Function menu.

USER INPUT ASSIGNMENT

The User Input Assignment is only active if the meter is programmed in the Dual Count Mode and a selection of reset, store, store and reset, inhibit, or print and reset is selected in the User Input Function menu.

EXAMPLE:

The counter display is used to indicate the total number of feet used in a process. It is necessary to know the number of pulses for the desired units to be displayed. The decimal point is selected to show the resolution in hundredths.

\[
\text{Scale Factor} = \frac{\text{Desired Display Units} \times \text{Decimal Point Position}}{\text{Number of Pulses}}
\]

Given that 128 pulses are equal to 1 foot, display total feet with a one-hundredth resolution.

- Scale Factor = \(\frac{1.00}{128}\) x 100
- Scale Factor = 0.007812 x 100
- Scale Factor = 0.7812

*For value entry instructions, refer to selection/value entry in the Programming The Meter section.
Module 2 is the programming for the Rate parameters. For maximum input frequency, Rate Enable should be set to No when not in use. When set to No, the remaining rate parameters are not accessible. The Rate value is shown with an annunciator of “r” in the Display Mode.

**RATE ENABLE**

| rt-Enb | No | Yes |

This selects the decimal point position for rate displays and any setpoint value assigned to these displays. This parameter does not affect rate scaling calculations.

**RATE DECIMAL POINT**

| rt-dPt |
|       |

Enter the desired Rate Display Value for the Scaling Point.*

**RATE SCALING DISPLAY VALUE**

| rt-SP | 0 to 999999 |

Enter the corresponding Rate Input Value for the Scaling Point.*

**SCALING FOR RATE INDICATION**

To scale the Rate, enter a Scaling Display value with a corresponding Scaling Input value. These values are internally plotted to a Display value of 0 and Input value of 0 Hz. A linear relationship is formed between these points to yield a rate display value that corresponds to the incoming input signal rate. The meter is capable of showing a rate display value for any linear process.

**SCALING CALCULATION**

If a display value versus input signal (in pulses per second) is known, then those values can be entered into Scaling Display (rt-SP) and Scaling Input (rt-INP). No further calculations are needed.

If only the number of pulses per ‘single’ unit (i.e. # of pulses per foot) is known, then it can be entered as the Scaling Input value and the Scaling Display value will be entered as the following:

<table>
<thead>
<tr>
<th>Rate Per</th>
<th>Display (rt-SP)</th>
<th>Input (rt-INP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second</td>
<td>1</td>
<td># of pulses per unit</td>
</tr>
<tr>
<td>Minute</td>
<td>60</td>
<td># of pulses per unit</td>
</tr>
<tr>
<td>Hour</td>
<td>3600</td>
<td># of pulses per unit</td>
</tr>
</tbody>
</table>

**NOTES:**

1. If # of pulse per unit is less than 1, then multiply both Input and Display values by 10.
2. If # of pulse per unit is less than 1, then multiply both Input and Display values by 100.
3. If the Display value is raised or lowered, then Input value must be raised or lowered by the same proportion (i.e. Display value for per hour is entered by a third less (1200) then Input value is a third less of # of pulses per unit). The same is true if the Input value is raised or lowered, then Display value must be raised or lowered by the same proportion.
4. Both values must be greater than 0.0.

**EXAMPLE:**

1. With 15.1 pulses per foot, show feet per minute in tenths. Scaling Display = 60.0 Scaling Input = 15.1.
2. With 0.25 pulses per gallon, show whole gallons per hour. (To have greater accuracy, multiply both Input and Display values by 10.) Scaling Display = 360000 Scaling Input = 2.5.

**INPUT FREQUENCY CALCULATION**

The meter determines the input frequency by summing the number of falling edges received during a sample period of time. The sample period begins on the first falling edge. At this falling edge, the meter starts accumulating time towards Low Update and High Update values. Also, the meter starts accumulating the number of falling edges. When the time reaches the Low Update value, the meter looks for one more falling edge to end the sample period. If a falling edge occurs (before the High Update Time value is reached), the Rate display will update to the new value and the next sample period will start on the same edge. If the High Update Time value is reached (without receiving a falling edge after reaching Low Update Time), then the sample...
period will end but the Rate display will be forced to zero. The High Update Time value must be greater than the Low Update Time value. Both values must be greater than 0.0. The input frequency calculated during the sample period, is then shown as a Rate value determined by the scaling calculation.

5.3 MODULE 3 - DISPLAY AND FRONT PANEL KEY PARAMETERS (3-dSP)

**FRONT PANEL DISPLAY SELECT ENABLE (SEL)**

The **YES** selection allows the **SEL** key to toggle through the enabled displays.

**FRONT PANEL COUNTER RESET ENABLE (RST)**

The **YES** selection allows the **RST** key to reset the selected counter(s). The shaded selections are only active when the meter is programmed for Dual Count Mode.

**DISPLAY SCROLL ENABLE**

The **YES** selection allows the display to automatically scroll through the enabled displays. The scroll rate is about every 4 seconds.

**DISPLAY INTENSITY LEVEL**

Enter the desired Display Intensity Level (1-5). The display will actively dim or brighten as levels are changed.

**LOAD FACTORY DEFAULT SETTINGS**

Selecting **YES** returns the meter to factory default settings. The meter displays **rESE** and returns to **Pr**, at which time all settings have been changed. Pressing **RST** on power-up loads the factory settings and displays **rESE**. This allows operation in the event of a memory failure or corrupted data.

### PROGRAMMING SECURITY CODE

The Security Code determines the programming mode and the accessibility of programming parameters. This code can be used along with the Program Mode Lock-out (**Prolac**) in the User Input Function parameter (Module 1).

Two programming modes are available. Full Programming mode allows all parameters to be viewed and modified. Quick Programming mode permits only the Setpoint value and Output Time-out value to be modified, but allows direct access to these values without having to enter Full Programming mode.

Programming a Security Code other than 0, requires this code to be entered at the **CodE** prompt in order to access Full Programming mode. Depending on the code value, Quick Programming may be accessible before the **CodE** prompt appears (see chart).

* Entering Code 222 allows access regardless of security code.
5.4 MODULE 4 - Setpoint Output Parameters (4-SPT)

Some parameters will not appear depending on the Setpoint Assignment and Setpoint Output Action selected.

**SETPOINT ASSIGNMENT**

Select the display the Setpoint is to be assigned.

**SETPOINT OUTPUT ACTION**

This parameter selects the action of the Setpoint output.

<table>
<thead>
<tr>
<th>SPT ACTION</th>
<th>DESCRIPTION</th>
<th>OUTPUT ACTIVATES</th>
<th>OUTPUT DEACTIVATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latched</td>
<td>Latched Output Mode</td>
<td>When Count = Setpoint</td>
<td>At Manual Reset (if D-Str = YES)</td>
</tr>
<tr>
<td>Timed</td>
<td>Timed Output Mode</td>
<td>When Count = Setpoint</td>
<td>After Setpoint Output Time-Out</td>
</tr>
<tr>
<td>Boundary</td>
<td>Boundary Mode</td>
<td>When Count ≥ Setpoint</td>
<td>When Count &lt; Setpoint</td>
</tr>
</tbody>
</table>

**SETPOINT OUTPUT TIME-OUT**

This parameter is only active if the Setpoint Action is set to timed output mode (4-Out). Enter the value in seconds that the output will be active, once the Setpoint Value is reached.

**SETPOINT VALUE**

Enter the desired Setpoint value. To enter a negative setpoint value, increment 6 to display a "-" sign.

---

**SETPOINT OUTPUT POWER-UP STATE**

ON will activate the output at power up. OFF will deactivate the output at power up. This parameter is not active when the Setpoint Action is selected for timed output mode.

**COUNTER A RESET ACTION**

When Counter A is reset, it returns to zero or the Setpoint Value. When the Reset Action is selected for Setpoint (Reset to Setpoint), the output activates at zero. This parameter does not appear for Boundary Mode Setpoint Action, where the meter always resets to zero.

**COUNTER A AUTO RESET**

This automatically resets the display value of Counter A each time the Setpoint Value is reached. The automatic reset occurs at output start or end. The 4-End is only active when setpoint output action is selected for 4-Out. This parameter does not appear for Boundary Mode Setpoint Action

**SETPOINT OUTPUT RESET WITH MANUAL RESET**

Select YES, so the Setpoint output will deactivate (reset) when a manual reset is applied to the meter. Manual reset can occur by the RST key or the User Input, if programmed for that function. When the Setpoint Assignment (4-ASS) is set to Count A, this parameter only applies to Count A reset.
Module 5 is the programming module for the Serial Communications Parameters. These parameters are used to match the serial settings of the meter with those of the host computer or other serial device. The Serial Setup plug jumers must be properly positioned for RS232 or RS485 serial communications prior to installing the meter.

### BAUD RATE

Set the baud rate to match that of other serial communications equipment. Normally, the baud rate is set to the highest value that all of the serial communications equipment is capable of transmitting and receiving.

### DATA BIT

Select either 7- or 8-bit data word length. Set the word length to match the other serial communications equipment on the serial link.

### PARITY BIT

This parameter only appears when the Data Bit parameter is set to a 7-bit data word length. Set the parity bit to match that of the other serial equipment on the serial link. The meter ignores parity when receiving data and sets the parity bit for outgoing data. If parity is set to NO, an additional stop bit is used to force the frame size to 10 bits.

### METER ADDRESS

Enter the serial node address. With a single unit, an address is not needed and a value of zero can be used (RS232 applications). Otherwise, with multiple bussed units, a unique address number must be assigned to each meter. The node address applies specifically to RS485 applications.

### ABBREVIATED PRINTING

This parameter determines the formatting of data transmitted from the meter in response to a Transmit Value command or a Block Print Request. Select NO for a full print transmission, consisting of the meter address, mnemonics, and parameter data. Select YES for abbreviated print transmissions, consisting of the parameter data only. This setting is applied to all the parameters selected in the PRINT OPTIONS. (Note: If the meter address is 0, the address will not be sent during a full transmission.)

### PRINT OPTIONS

This parameter selects the meter values transmitted in response to a Print Request. A print request is also referred to as a block print because more than one parameter can be sent to a printer or computer as a block.

Selecting YES displays a sublist for choosing the meter parameters to appear in the print block. All active parameters entered as YES in the sublist will be transmitted during a block print. Parameters entered as NO will not be sent.

The “Print All” (Pr-ALL) option selects all meter values for transmitting (YES), without having to individually select each parameter in the sublist. Note: Inactive parameters will not be sent regardless of the print option setting. For example, Counter B or Scale Factor B will only be sent when the meter is programmed for Dual Counter mode. In any other count mode, these parameters are inactive and will not be transmitted. Likewise, the Rate value will not be sent unless the Rate Display is enabled.
Sending Serial Commands and Data

When sending commands to the meter, a string containing at least one command character must be constructed. A command string consists of a command character, a value identifier, numerical data (if writing data to the meter) followed by a command terminator character, * or $.

Command Chart

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Node (meter) Address Specifier</td>
<td>Address a specific meter. Must be followed by one or two digit node address. Not required when node address = 0.</td>
</tr>
<tr>
<td>T</td>
<td>Transmit Value (read)</td>
<td>Read a register from the meter. Must be followed by a register ID character.</td>
</tr>
<tr>
<td>V</td>
<td>Value Change (write)</td>
<td>Write to register of the meter. Must be followed by a register ID character and numeric data.</td>
</tr>
<tr>
<td>R</td>
<td>Reset</td>
<td>Reset a count value or the output. Must be followed by a register ID character.</td>
</tr>
<tr>
<td>P</td>
<td>Block Print Request (read)</td>
<td>Initiates a block print output. Registers in the print block are selected in Print Options.</td>
</tr>
</tbody>
</table>

Command String Construction

The command string must be constructed in a specific sequence. The meter does not respond with an error message to illegal commands. The following procedure details construction of a command string:

1. The first 2 or 3 characters consist of the Node Address Specifier (N) followed by a 1 or 2 character node address number. The node address number of the meter is programmable. If the node address is 0, this command and the node address itself may be omitted. This is the only command that may be used in conjunction with other commands.
2. After the optional address specifier, the next character is the command character.
3. The next character is the register ID. This identifies the register that the command affects. The P command does not require a register ID character. It prints all the active selections chosen in the Print Options menu parameter.
4. If constructing a value change command (writing data), the numeric data is sent next.
5. All command strings must be terminated with the string termination characters * or $. The meter does not begin processing the command string until this character is received. See timing diagram figure for differences in meter response time when using the * and $ terminating characters.

Receiving Data From The Meter

Data is transmitted from the meter in response to either a transmit command (T), a block print request command (P) or a User Input print request. The response from the meter is either a full field transmission or an abbreviated transmission, depending on the selection chosen in Module 5.

Full Field Transmission

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2</td>
<td>2 byte Node Address field [00-99]</td>
</tr>
<tr>
<td>3</td>
<td>&lt;SP&gt; (Space)</td>
</tr>
<tr>
<td>4-6</td>
<td>3 byte Register Mnemonic field</td>
</tr>
<tr>
<td>7-18</td>
<td>12 byte data field; 10 bytes for number, one byte for sign, one byte for decimal point</td>
</tr>
</tbody>
</table>

Abbreviated Transmission

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-12</td>
<td>12 byte data field, 10 bytes for number, one byte for sign, one byte for decimal point</td>
</tr>
<tr>
<td>13</td>
<td>&lt;CR&gt; (carriage return)</td>
</tr>
<tr>
<td>14</td>
<td>&lt;LF&gt; (line feed)</td>
</tr>
<tr>
<td>15</td>
<td>&lt;SP&gt; (Space)</td>
</tr>
<tr>
<td>16</td>
<td>&lt;CR&gt; (carriage return)</td>
</tr>
<tr>
<td>17</td>
<td>&lt;LF&gt; (line feed)</td>
</tr>
</tbody>
</table>

* These characters only appear in the last line of a block print.

The abbreviated response suppresses the node address and register ID, leaving only the numeric part of the response.

Meter Response Examples:

1. Node address = 17, full field response, Counter A = 875
   17 CTA 875 <CR><LF>
2. Node address = 0, full field response, Setpoint = -250.5
   SPT -250.5<CR><LF>
3. Node address = 0, abbreviated response, Setpoint = 250, last line of block print
   250<CR><LF><SP><CR><LF>

Register Identification Chart

<table>
<thead>
<tr>
<th>ID</th>
<th>Value Description</th>
<th>MNEMONIC</th>
<th>Applicable Commands</th>
<th>Transmit Details (T and V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Counter A</td>
<td>CTA</td>
<td>T, V, R</td>
<td>6 digit/5 digit negative (with minus sign)</td>
</tr>
<tr>
<td>B</td>
<td>Counter B</td>
<td>CTB</td>
<td>T, V, R</td>
<td>5 digit, positive only</td>
</tr>
<tr>
<td>C</td>
<td>Rate</td>
<td>RTE</td>
<td>T</td>
<td>5 digit, positive only</td>
</tr>
<tr>
<td>D</td>
<td>Scale Factor A</td>
<td>SFA</td>
<td>T, V</td>
<td>6 digit, positive only</td>
</tr>
<tr>
<td>E</td>
<td>Scale Factor B</td>
<td>SFB</td>
<td>T, V</td>
<td>6 digit, positive only</td>
</tr>
<tr>
<td>F</td>
<td>Setpoint (Reset Output)</td>
<td>SPT</td>
<td>T, V, R</td>
<td>per setpoint Assignment, same as Counter A or Rate</td>
</tr>
</tbody>
</table>
**Command Response Time**

The meter can only receive data or transmit data at any one time (half-duplex operation). During RS232 transmissions, the meter ignores commands while transmitting data, but instead uses RXD as a busy signal. When sending commands and data to the meter, a delay must be imposed before sending another command. This allows enough time for the meter to process the command and prepare for the next command.

At the start of the time interval $t_1$, the computer program prints or writes the string to the com port, thus initiating a transmission. During $t_1$, the command characters are under transmission and at the end of this period, the command terminating character (* or $) is received by the meter. The time duration of $t_1$ is dependent on the number of characters and baud rate of the channel.

$$t_1 = \frac{10 \times \text{# of characters}}{\text{baud rate}}$$

At the start of time interval $t_2$, the meter starts the interpretation of the command and when complete, performs the command function. This time interval $t_2$ varies. If no response from the meter is expected, the meter is ready to accept another command.

If the meter is to reply with data, the data transmission always begins with the start bit. The start bit signals the receiving device to prepare for reception of data. One bit period later, the least significant bit of the ASCII encoded character is transmitted, followed by the remaining data bits. The receiving device then reads each bit position as they are transmitted.

**Parity Bit**

After the data bits, the parity bit is sent. The transmitter sets the parity bit to a zero or a one, so that the total number of ones contained in the transmission (including the parity bit) is either even or odd. This bit is used by the receiver to detect errors that may occur to an odd number of bits in the transmission. However, a single parity bit cannot detect errors that may occur to an even number of bits. Given this limitation, the parity bit is often ignored by the receiving device. The meter ignores the parity bit of incoming data and sets the parity bit to odd, even or none (mark parity) for outgoing data.

**Stop Bit**

The last character transmitted is the stop bit. The stop bit provides a single bit period pause to allow the receiver to prepare to re-synchronize to the start of a new transmission (start bit of next byte). The receiver then continuously looks for the occurrence of the start bit. If 7 data bits and no parity is selected, then 2 stop bits are sent from the meter.
Press PAR key to enter Programming Mode.
LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
GENERAL DESCRIPTION

The Large Display Timer and Cycle Counter is a versatile display that functions as an Elapsed Timer or Preset Timer, with full-featured user programmability. The meter includes a built-in Cycle Counter, relay output and serial communications capability. The 6 digit displays are available in either 2.25” or 4” high red LED digits with adjustable display intensity. The 2.25” high models are readable up to 130 feet. The 4” high models are readable up to 180 feet. Both versions are constructed of a NEMA 4 enclosure in light weight aluminum.

The Timer has two signal inputs and eight input operating modes. These modes provide level active or edge triggered start/stop operation. The Timer features 18 selectable timer ranges to cover a wide variety of timing applications. The built-in Cycle Counter can be linked to timer operation to count timing cycles, or function as a totally independent counter, accepting count speeds up to 500 Hz. The display can be toggled either manually or automatically between the Timer and Counter values.

In addition to the Timer/Counter inputs, a programmable User Input is provided to perform a variety of meter functions. DIP switches are used to configure the inputs for current sinking (active low) or current sourcing (active high) operation.

The Setpoint Output can be assigned to the Timer or Counter value, and configured to suit a variety of control and alarm requirements. The meter also includes jumper selectable RS232 or RS485 serial communications.

SAFETY SUMMARY

All safety regulations, local codes and instructions that appear in this and corresponding literature, or on equipment, must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

The protective conductor terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing system.

SPECIFICATIONS

1. DISPLAY: 2.25” (57 mm) or 4” (101 mm) intensity adjustable Red LED
2. POWER REQUIREMENTS:
   AC Power:
   - AC Input: 85 to 250 VAC 50/60 Hz, 14 VA
   - DC Out: 11 to 16 VDC @ 50 mA (consult factory for higher current draw)
   DC Power:
   - DC Input: 11 to 16 VDC @ 400 mA max, 7 W
3. TIMER DISPLAY: 6-digits
   Display Range: 0 to 999999
   Overflow/Underflow Indication: Display flashes “U 07&S”
   Minimum Digit Resolution: 0.001 Sec.
   Maximum Single Digit Resolution: 1 Hr.
   Timing Accuracy: ±0.01%
4. CYCLE COUNTER DISPLAY: 5-digits, may be disabled if not used
   Display Designator: “$” to the left side of the display
   Display Range: 0 to 99999
   Overflow/Underflow Indication: Display flashes “$ 07&S”

DIMENSIONS  In inches (mm)

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>X (Length)</th>
<th>Y (Height)</th>
<th>Z (Center)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD2T06P0</td>
<td>16 (406.4)</td>
<td>4 (101.6)</td>
<td>12 (304.8)</td>
</tr>
<tr>
<td>LD4T06P0</td>
<td>26 (660.4)</td>
<td>7.875 (200)</td>
<td>22 (558.8)</td>
</tr>
</tbody>
</table>
ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD:</td>
<td>2.25&quot; High 6-Digit Red LED Timer/Cycle Counter w/</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relay Output &amp; RS232/RS485 Serial Communications</td>
<td>LD2T06P0</td>
</tr>
<tr>
<td></td>
<td>4&quot; High 6-Digit Red LED Timer/Cycle Counter w/</td>
<td>LD4T06P0</td>
</tr>
<tr>
<td></td>
<td>Relay Output &amp; RS232/RS485 Serial Communications</td>
<td></td>
</tr>
</tbody>
</table>

1.0 Installing the Meter

INSTALLATION
The meter meets NEMA 4X/IP65 requirements when properly installed.

INSTALLATION ENVIRONMENT
The unit should be installed in a location that does not exceed the operating temperature. Placing the unit near devices that generate excessive heat should be avoided.

The unit should only be cleaned with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the front overlay. Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

11. ENVIRONMENTAL CONDITIONS:
Operating temperature: 0 to 50 °C
Storage temperature: -40 to 70 °C
Operating and storage humidity: 0 to 85% RH (non-condensing)
Altitude: Up to 2,000 meters

12. CERTIFICATIONS AND COMPLIANCES:

SAFETY
UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M95
LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
Type 4X Enclosure rating (Face only), UL50
IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
IP65 Enclosure rating (Face only), IEC 529

ELECTROMAGNETIC COMPATIBILITY
Emissions and Immunity to EN 61326: Electrical Equipment for Measurement, Control and Laboratory use.

Immunity to Industrial Locations:
Electrostatic discharge EN 61000-4-2
4 kV contact discharge
10 V/m
Fast transients (burst) EN 61000-4-4
2 kV power
1 kV signal
Surge EN 61000-4-5
2 kV L-N-E power
RF conducted interference EN 61000-4-6
3 V/rms

Emissions:
Emissions EN 55011
Class B

Notes:
2. DC Power: Shaffner FN610-1/07 line filter installed on DC power cable to comply.


14. WEIGHT:
LD2T06P0 - 4.5 lbs (2.04 kg)
LD4T06P0 - 10.5 lbs (4.76 kg)
1. The meter should be properly connected to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the meter and leave the other end of the shield unconnected and insulated from earth ground.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far as possible from contacts, control relays, transformers, and other noisy components.
5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   - Ferrite Suppression Cores for signal and control cables: Schaffner # FN610-1/07 (RLC# LFIL0000)
   - Ferrite Suppression Cores for signal and control cables: Steward # 28B2029-0A0
   - Ferrite Suppression Cores for signal and control cables: Fair-Rite # 0443167251 (RLC# FCOR0000)
   - Ferrite Suppression Cores for signal and control cables: TDK # ZCAT3035-1330A
   - Ferrite Suppression Cores for signal and control cables: Corcom # 1 VR3
   - Line Filters for input power cables: Schaffner # FN610-1/07 (RLC# LFIL0000)
   - Line Filters for input power cables: Schaffner # FN670-1.8/07
   - Line Filters for input power cables: Fair-Rite # 0443167251
   - Line Filters for input power cables: Steward # 28B2029-0A0
   - Line Filters for input power cables: TDK # ZCAT3035-1330A
   - Line Filters for input power cables: Corcom # 1 VR3

Note: Reference manufacturer’s instructions when installing a line filter.
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   - Snubber: RLC# SNUB0000.
3.1 POWER WIRING

The power wiring is made via the 5 position terminal block (TBA) located inside unit (right side).

Do not power unit from both AC & DC at the same time.

**AC Power**
- Terminal 1: VAC
- Terminal 2: VAC
- Terminal 3: Earth Ground
- Terminal 4: +DC Out
- Terminal 5: DC Common

**DC Power**
- Terminal 3: Earth Ground
- Terminal 4: +DC Input
- Terminal 5: DC Common

3.2 USER INPUT WIRING

The Reset/User Input is always Terminal 3 and Input Common is always terminal 4 of TBB located inside the unit (right side).

**Sinking Logic**
- DIP switch 6 OFF

**Sourcing Logic**
- DIP switch 6 ON

3.3 SETPOINT (OUTPUT) WIRING

The setpoint relay uses a three position terminal block (TBC) located on the left side of the LD2 model, and on the right side for the LD4 model.

**Terminal 1:** NC
**Terminal 2:** NO
**Terminal 3:** Relay Common
3.4 INPUT WIRING

The Large Display Timer is equipped with two signal inputs, A and B. These inputs are wired using the six position terminal block (TBB) located inside the unit on the right side.

**CAUTION:** DC common is NOT isolated from input common. In order to preserve the safety of the meter application, the DC common must be suitably isolated from hazardous live earth referenced voltage; or input common must be at protective earth ground potential. If not, hazardous voltage may be present at the User Input and Input Common terminals. Appropriate considerations must then be given to the potential of the input common with respect to earth ground.

<table>
<thead>
<tr>
<th>Two Wire Proximity, Current Source</th>
<th>Current Sinking Output</th>
<th>Current Sourcing Output</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
<td><img src="image3.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

**Interfacing With TTL**

<table>
<thead>
<tr>
<th>Switch or Isolated Transistor; Current Sink</th>
<th>Switch or Isolated Transistor; Current Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4.png" alt="Diagram" /></td>
<td><img src="image5.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

* Switch position is application dependent.

3.5 SERIAL WIRING

Serial communications is jumper selectable for RS485 or RS232. From the factory, the unit is defaulted to RS485 communications. If RS232 is desired, both serial jumpers will need changed to the RS232 positions before wiring.

**RS485**

- **TBA:**
  - INP A 1
  - INP B 2
  - RESET USER 3
  - INP COMM 4
- **TBB:**
  - A (TXD) 5
  - B (RXD) 6

**RS232**

- **TBA:**
  - INP A 1
  - INP B 2
  - RESET USER 3
  - INP COMM 4
- **TBB:**
  - A (TXD) 5
  - B (RXD) 6

**RS485 Communications**

Equipment (DCE) receives data on the TXD line and transmits data on the RXD line. The PAX emulates a DTE. If the other device connected to the meter also emulates a DTE, the TXD and RXD lines must be interchanged for communications to take place. This is known as a null modem connection. Most printers emulate a DCE device while most computers emulate a DTE device.

Some devices cannot accept more than two or three characters in succession without a pause in between. In these cases, the meter employs a busy function. As the meter begins to transmit data, the RXD line (RS232) is monitored to determine if the receiving device is “busy.” The receiving device asserts that it is busy by setting the RXD line to a space condition (logic 0). The meter then suspends transmission until the RXD line is released by the receiving device.

**RS485 Communications**

The RS485 communication standard allows the connection of up to 32 devices on a single pair of wires, distances up to 4,000 ft. and data rates as high as 10M baud (the LD is limited to 19.2k baud). The same pair of wires is used to both transmit and receive data. RS485 is therefore always half-duplex, that is, data cannot be received and transmitted simultaneously.

**RS232 Communications**

RS232 is intended to allow two devices to communicate over distances up to 50 feet. Data Terminal Equipment (DTE) transmits data on the Transmitted Data (TXD) line and receives data on the Received Data (RXD) line. Data Computer

**Terminal Block Connection Figure**

![Diagram](image6.png)

* OPTIONAL
4.0 Reviewing the Front Panel Keys and Display

It is recommended all programming changes be made offline, or before installation. The meter normally operates in the Display Mode. No parameters can be programmed in this mode. The Programming Mode is entered by pressing the PAR key. If it is not accessible, then it is locked by either a security code or a hardware lock (See Module 3).

Module Entry (SEL▲ & PAR Keys)
The Programming Menu is organized into five modules. These modules group together parameters that are related in function. The display will alternate between Prs and the present module. The SEL▲ key is used to select the desired module. The displayed module is entered by pressing the PAR key.

Module Menu (PAR Key)
Each module has a separate module menu (which is shown at the start of each module discussion). The PAR key is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters. After completing a module, the display will return to Prs NO. Programming may continue by accessing additional modules.

Selection / Value Entry
For each parameter, the display alternates between the present parameter and the selections/value for that parameter. The SEL▲ and RST▼ keys are used to move through the selections/values for that parameter. Pressing the PAR key, stores and activates the displayed selection/value. This also advances the meter to the next parameter.

For numeric values, the value is displayed with one digit flashing (initially the left most digit). Pressing the SEL▲ key increments the digit by one or the user can hold the SEL▲ key and the digit will automatically scroll. The RST▼ key will select the next digit to the right. Pressing the PAR key will enter the value and move to the next parameter.

Operating Mode Display Designators
"£" - To the left of the display is the Cycle Counter value.
"." - Decimal point to the far right of the display indicates the setpoint status.

5.0 Programming the Meter

Programming Mode Entry (PAR Key)
It is recommended all programming changes be made off line, or before installation. The meter normally operates in the Display Mode. No parameters can be programmed in this mode. The Programming Mode is entered by pressing the PAR key. If it is not accessible, then it is locked by either a security code or a hardware lock (See Module 3).

Module Entry (SEL▲ & PAR Keys)
The Programming Menu is organized into five modules. These modules group together parameters that are related in function. The display will alternate between Prs and the present module. The SEL▲ key is used to select the desired module. The displayed module is entered by pressing the PAR key.

Module Menu (PAR Key)
Each module has a separate module menu (which is shown at the start of each module discussion). The PAR key is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters. After completing a module, the display will return to Prs NO. Programming may continue by accessing additional modules.

Selection / Value Entry
For each parameter, the display alternates between the present parameter and the selections/value for that parameter. The SEL▲ and RST▼ keys are used to move through the selections/values for that parameter. Pressing the PAR key, stores and activates the displayed selection/value. This also advances the meter to the next parameter.

For numeric values, the value is displayed with one digit flashing (initially the left most digit). Pressing the SEL▲ key increments the digit by one or the user can hold the SEL▲ key and the digit will automatically scroll. The RST▼ key will select the next digit to the right. Pressing the PAR key will enter the value and move to the next parameter.

Programming Mode Exit (PAR Key)
The Programming Mode is exited by pressing the PAR key with Prs NO displayed. This will commit any stored parameter changes to memory and return the meter to the Display Mode. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)

Programming Tips
It is recommended to start with Module 1 and proceed through each module in sequence. When programming is complete, it is recommended to record the parameter programming and lock out parameter programming with the user input or programming security code.

Factory Settings
Factory Settings may be completely restored in Module 3. This is useful when encountering programming problems.
Pressing the RST▼ key on power-up will load the factory settings and display rESeT. This allows operations in the event of a memory failure or corrupted data.

Alternating Selection Display
In the explanation of the modules, the following dual display with arrows will appear. This is used to illustrate the display alternating between the parameter on top and the parameter’s Factory Setting on the bottom. In most cases, selections and values for the parameter will be listed on the right.
5.1 MODULE 1 - TIMER INPUT PARAMETERS (I-1NP)

**PARAMETER MENU**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timer Range</td>
<td>( r )</td>
<td>( r )</td>
</tr>
<tr>
<td>Timer Input Operation</td>
<td>( I )</td>
<td>( I )</td>
</tr>
<tr>
<td>Timer Input Filter</td>
<td>( F )</td>
<td>( F )</td>
</tr>
<tr>
<td>Timing Direction</td>
<td>( d )</td>
<td>( d )</td>
</tr>
<tr>
<td>Timer Start Value</td>
<td>( S )</td>
<td>( S )</td>
</tr>
<tr>
<td>Timer Stop Value</td>
<td>( E )</td>
<td>( E )</td>
</tr>
<tr>
<td>Flash Timer Run Indicator</td>
<td>( L )</td>
<td>( L )</td>
</tr>
<tr>
<td>Timer Run State At Power-up</td>
<td>( P )</td>
<td>( P )</td>
</tr>
<tr>
<td>Timer Reset At Power-up</td>
<td>( R )</td>
<td>( R )</td>
</tr>
<tr>
<td>User Input Function</td>
<td>( U )</td>
<td>( U )</td>
</tr>
<tr>
<td>User Input Assignment</td>
<td>( A )</td>
<td>( A )</td>
</tr>
</tbody>
</table>

**TIMER RANGE**

<table>
<thead>
<tr>
<th>Range Selection</th>
<th>Maximum Display Value</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECONDS</td>
<td>999999999</td>
<td>1 SEC</td>
</tr>
<tr>
<td>SECONDS</td>
<td>999999999</td>
<td>0.1 SEC</td>
</tr>
<tr>
<td>MINUTES</td>
<td>999999999</td>
<td>0.01 SEC</td>
</tr>
<tr>
<td>HOURS</td>
<td>999999999</td>
<td>1 HR</td>
</tr>
<tr>
<td>HOURS</td>
<td>999999999</td>
<td>0.1 HR</td>
</tr>
<tr>
<td>HOURS</td>
<td>999999999</td>
<td>0.01 HR</td>
</tr>
</tbody>
</table>

**TIMER INPUT OPERATIONS**

<table>
<thead>
<tr>
<th>Level Active (Gated) Operation</th>
<th>Edge Triggered Operation - 1 Input</th>
<th>Edge Triggered Operation - 2 Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT A</td>
<td>INPUT A</td>
<td>INPUT A</td>
</tr>
<tr>
<td>INPUT B - Timer Inhibit (Level Active)</td>
<td>INPUT B - Timer Inhibit (Level Active)</td>
<td>INPUT B - Timer Inhibit (Level Active)</td>
</tr>
</tbody>
</table>

**TIMER INPUT FILTER**

Provides a 50 msec software debounce for the Timer Inputs (A and B). Select **OFF** when using relays or switch contacts as a signal source.

**TIMING DIRECTION**

<table>
<thead>
<tr>
<th>Timing Direction</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bi-directional</td>
<td>UP, dn</td>
</tr>
</tbody>
</table>

**TIMER START VALUE**

The Timer returns to this value whenever a Timer Reset occurs. The value is entered in the same display format as the Timer Range selected. Non-zero values are normally used for “timing down” applications, but they can also provide an offset value when timing up.

**TIMER STOP VALUE**

<table>
<thead>
<tr>
<th>Stop Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>000000 to 999999</td>
</tr>
<tr>
<td>Yes</td>
<td>000000 to 999999</td>
</tr>
</tbody>
</table>

**FLASH TIMER RUN INDICATOR**

Select **YES** to have the Timer Run indicator flash when the timer is running.

**TIMER RUN STATE AT POWER-UP**

Determines the Run/Stop state of the Timer at power-up. This parameter does not apply to **Level Active** Input Operation.

- **Stop** - Timer Stopped at power-up, regardless of prior Run/Stop state
- **Save** - Timer assumes the Run/Stop state it was in prior to power-down

For Reset Modes (\( S4U \)), the timer is reset at Time Start edge.

This parameter determines how the Timer Input Signals affect the Run/Stop status of the Timer. Timing diagrams are shown below for level active and edge triggered (1-input or 2-input) operation. For single input modes (Input A only), Input B provides a level active Timer Inhibit function. In the Display Hold mode, the timer display value remains held and only updates when a Timer Start (Input A) or Timer Stop (Input B) edge occurs.

The timer reset (\( S4U \)) operating modes are identical to the other modes in the diagrams, except the timer display value is reset at the Time Start edges.

The Timer can also be stopped at a Timer Stop Value or at Setpoint output activation or deactivation. This type of Stop condition is cleared when a Timer Reset occurs, or another start edge is applied on the timer input.
Module 2 - Cycle Counter Parameters

**PARAMETER MENU**

- **Cen-E** - Cycle Counter Enable
- **C-srC** - Cycle Counter Count Source
- **C-dir** - Cycle Counter Counting Direction
- **C-str** - Cycle Counter Start Value
- **r-UP** - Cycle Counter Reset At Power-up

**USER INPUT FUNCTION**

- **USr**
- **INP**

**DISPLAY**

- **NO** - No Function
- **Pr** - Program Mode Lock-out
- **d-SEL** - Display Select
- **r-SE** - Maintained Reset
- **d-HOLD** - Display Hold
- **Hd-r** - Hold and Reset

**DESCRIPTION**

- User Input disabled.
- See Programming Mode Access chart (Module 3).
- Toggle display with each activation.
- Level active reset of the selected value(s).
- Freeze display for the selected value(s) while allowing time or counts to accumulate internally.
- Edge triggered reset of the selected value(s) after storing the time or count.

**USER INPUT ASSIGNMENT**

- **USr**
- **INP**
- **An**
- **r-VAL**
- **c-VAL**

**USER INPUT FUNCTION (Cont’d)**

- **Inh** - Inhibit
- **d-LEU** - Display Intensity Level (Edge Triggered)
- **Pr** - Print Request
- **Pr-r** - Print and Reset
- **r-r** - Reset Output

**DISPLAY**

- **NO**

**DESCRIPTION**

- Inhibit timing or counting for the selected value(s).
- Increase intensity one level for each activation.
- Serial transmit of the active parameters selected in the Print Options menu (Module 5).
- Same as Print Request followed by a momentary reset of the selected value(s).
- Edge triggered deactivation of the Setpoint Output.

**CYCLE COUNTER ENABLE**

When set to **NO**, the remaining Cycle Counter parameters are not accessible.

**CYCLE COUNTER COUNT SOURCE**

This parameter selects the source from which the Cycle Counter derives counts. The Timer Reset (r-SE) selection generates a count when either a manual or automatic timer reset occurs (See Module 4 for programming Automatic Reset). The Input B (INP b) selection generates a count each time Input B is activated. This selection overrides the timer inhibit function of Input B, when the timer is programmed for Level or Edge-1 operating mode (See Module 1 for Timer Input Operating Modes).

The User Input (USr INP) selection generates a count each time the User Input is activated. When selected as the count source, the User Input can still be set to perform a User Function described in Module 1. In this case, the Cycle Counter will count the number of times the selected User Function occurred.

The Output ON/OFF selections generate a count when the Setpoint output either activates or deactivates.

**CYCLE COUNTER COUNTING DIRECTION**

Bi-directional counting capability. Select the counting direction desired for the application.

**CYCLE COUNTER START VALUE**

The Cycle Counter returns to this value whenever a Counter Reset occurs. Non-zero values are normally used for “down counting” applications, but can also provide an offset value when counting up.

**CYCLE COUNTER RESET AT POWER-UP**

The Cycle Counter can be programmed to Reset at each meter power-up.
5.3 MODULE 3 - DISPLAY AND FRONT PANEL KEY

PARAMETERS (3-dSP)

**FRONT PANEL DISPLAY SELECT ENABLE (SELenant)**

The YES selection allows the SELenant key to toggle between the timer and cycle counter displays.

**FRONT PANEL RESET ENABLE (RST▼)**

The YES selection allows the RST▼ key to reset the selected value(s). The shaded selections only appear if the cycle counter is enabled.

**DISPLAY SCROLL ENABLE**

The YES selection allows the display to automatically scroll between the timer and cycle counter values. The scroll rate is about every 4 seconds.

**DISPLAY INTENSITY LEVEL**

Enter the desired Display Intensity Level (1-5). The display will actively dim or brighten as levels are changed.

**PROGRAMMING SECURITY CODE**

The Security Code determines the programming mode and the accessibility of programming parameters. This code can be used along with the Program Mode Lock-out (Prolac) in the User Input Function parameter (Module 1).

Two programming modes are available. Full Programming mode allows all parameters to be viewed and modified. Quick Programming mode permits only the Setpoint values and Timer Stop value to be modified, but allows direct access to these values without having to enter Full Programming mode.

Programming a Security Code other than 0, requires this code to be entered at the Code prompt in order to access Full Programming mode. Depending on the code value, Quick Programming may be accessible before the Code prompt appears (see chart).

<table>
<thead>
<tr>
<th>USER INPUT FUNCTION</th>
<th>USER INPUT STATE</th>
<th>SECURITY CODE</th>
<th>MODE WHEN “PAR” KEY IS PRESSED</th>
<th>FULL PROGRAMMING MODE ACCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>not Prolac</td>
<td>0</td>
<td>Full Programming</td>
<td>Immediate Access</td>
<td></td>
</tr>
<tr>
<td>Prolac</td>
<td>1-99</td>
<td>Quick Programming</td>
<td>After Quick Programming with correct code entry at Code prompt *</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100-999</td>
<td>Code prompt</td>
<td>With correct code entry at Code prompt *</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Programming Lock</td>
<td>No Access</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-99</td>
<td>Quick Programming</td>
<td>No Access</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100-999</td>
<td>Code prompt</td>
<td>With correct code entry at Code prompt *</td>
<td></td>
</tr>
</tbody>
</table>

* Entering Code 222 allows access regardless of security code.

**LOAD FACTORY DEFAULT SETTINGS**

The YES selection will return the meter to the factory default settings. The meter will display rESET and then return to Pro, at which time all settings have been changed.

Pressing the RST▼ key on power-up will load the factory settings and display rESET. This allows operation in the event of a memory failure or corrupted data.
5.4 MODULE 4 - SETPOINT OUTPUT PARAMETERS (4-SPt)

Module 4 is the programming module for the Setpoint Output parameters. Some parameters will not appear depending on the Setpoint Assignment and Setpoint Output Action selected.

SETPOINT ASSIGNMENT

Select the display for Setpoint assignment.

SETPOINT OUTPUT ACTION

This parameter selects the action of the Setpoint output as shown below.

<table>
<thead>
<tr>
<th>SPT ACTION</th>
<th>DESCRIPTION</th>
<th>OUTPUT ACTIVATES</th>
<th>OUTPUT DEACTIVATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>LATCH</td>
<td>Latched Output Mode</td>
<td>When Time or Count = Setpoint On value</td>
<td>At Manual Reset (if OrSt-r = YES)</td>
</tr>
<tr>
<td>L-Out</td>
<td>Timed Output Mode</td>
<td>When Time or Count = Setpoint On value</td>
<td>After Setpoint Output Time-Out</td>
</tr>
<tr>
<td>On-Off</td>
<td>On-Off Output Mode</td>
<td>When Time or Count = Setpoint On value</td>
<td>When Time or Count = Setpoint Off value</td>
</tr>
</tbody>
</table>

SETPOINT ON

This parameter determines when the Setpoint output will activate. The output can activate at a programmed Setpoint Value or can be set to activate when the Timer starts (L-St-r) or stops (L-St-DP).

Selecting VALUE displays a sub-menu where the Setpoint Value is entered. If the Setpoint is assigned to the Timer, the value is entered in the same display format as the selected Timer Range.

SETPOINT OFF

The Setpoint Off parameter only appears if the Setpoint Action is set to On-Off Output mode (0/0''). In this mode, the Setpoint OFF parameter determines when the Setpoint Output will deactivate. The output can be programmed to deactivate at a Setpoint Off Value or can be set to deactivate when the Timer starts (L-St-r) or stops (L-St-DP).

Selecting VALUE displays a sub-menu where the Setpoint Off Value is entered. If the Setpoint is assigned to the Timer, the value is entered in the same display format as the selected Timer Range.

SETPOINT OUTPUT TIME-OUT

This parameter is only active if the Setpoint Action is set to Timed Output mode (L-Out). Enter the time duration the Setpoint Output will remain ON once it is activated. This value is always entered in minutes, seconds, and hundredths of seconds format. The maximum value is 99 minutes 59.99 seconds.

STOP TIMER

Stops the Timer when the Setpoint output activates (0/0) or deactivates (0/0''). Select NO if the output should not affect the Timer Run/Stop status. The Timer Stop condition is cleared when a Timer Reset occurs, or a Time Start edge is applied on the Timer input.

TIMER/COUNTER AUTO RESET

Automatically resets the Setpoint Assigned display value when the Setpoint Output activates (0/0) or deactivates (0/0''). Select NO if the output should not cause a display reset.

SETPOINT OUTPUT RESET WITH DISPLAY RESET

Select YES to have the Setpoint Output deactivate (reset) when the Setpoint Assigned display resets. Reset can occur by the RST key or the User Input, if programmed for that function. Select NO if the Setpoint output should not reset when the display resets.

SETPOINT OUTPUT POWER-UP STATE

SAV will restore the output to the same state it was at before the meter was powered down. ON will activate the output at power up. OFF will deactivate the output at power up. This parameter is not active when the Setpoint Action is selected for timed output mode.
Module 5 is the programming module for the Serial Communications Parameters. These parameters are used to match the serial settings of the meter with those of the host computer or other serial device.

### Parameter Menu

- **Baud Rate (BAud)**
  - Options: 300, 1200, 4800, 9600, 600, 2400, 7200, 19200
  - Setting: 9600

  Set the baud rate to match that of other serial communications equipment. Normally, the baud rate is set to the highest value that all of the serial communications equipment is capable of transmitting and receiving.

- **Data Bit (dAtA)**
  - Options: 7-bit, 8-bit

  Select either 7- or 8-bit data word length. Set the word length to match the other serial communications equipment on the serial link.

- **Parity Bit (Par ItY)**
  - Options: Odd, Even, None

  This parameter only appears when the Data Bit parameter is set to a 7-bit data word length. Set the parity bit to match that of the other serial equipment on the serial link. The meter ignores parity when receiving data and sets the parity bit for outgoing data. If parity is set to None, an additional stop bit is used to force the frame size to 10 bits.

- **Meter Address (Addr)**
  - Range: 0 to 99

  Enter the serial node address. With a single unit, an address is not needed and a value of zero can be used (RS232 applications). Otherwise, with multiple bussed units, a unique address number must be assigned to each meter. The node address applies specifically to RS485 applications.

### Abbreviated Printing (Abbr)

- **Default:** No

  This parameter determines the formatting of data transmitted from the meter in response to a Transmit Value command or a Block Print Request. Select No for a full print transmission, consisting of the meter address, mnemonics, and parameter data. Select Yes for abbreviated print transmissions, consisting of the parameter data only. This setting is applied to all the parameters selected in the PRINT OPTIONS. (Note: If the meter address is 0, the address will not be sent during a full transmission.)

### Print Options (Pr - OpT)

- **Default:** No

  This parameter selects the meter values transmitted in response to a Print Request. A print request is also referred to as a block print because more than one parameter can be sent to a printer or computer as a block.

  Selecting Yes displays a sublist for choosing the meter parameters to appear in the print block. All active parameters entered as Yes in the sublist will be transmitted during a block print. Parameters entered as No will not be sent.

  The “Print All” (Pr - ALL) option selects all meter values for transmitting (Yes), without having to individually select each parameter in the sublist.

  Note: Inactive parameters will not be sent regardless of the print option setting. For example, the Cycle Counter and Cycle Counter Start values will only be sent when the Cycle Counter is enabled. If disabled, these parameters are inactive and will not be transmitted. Likewise, only the Setpoint parameters that apply to the programmed Setpoint Output Action will be transmitted.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
<th>Factory Setting</th>
<th>Mnemonic</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>t</code> - <code>URL</code></td>
<td>Timer</td>
<td>Yes</td>
<td>TMR</td>
</tr>
<tr>
<td><code>c</code> - <code>URL</code></td>
<td>Cycle Counter</td>
<td>No</td>
<td>CNT</td>
</tr>
<tr>
<td><code>t</code> - <code>St</code></td>
<td>Timer Start</td>
<td>No</td>
<td>TST</td>
</tr>
<tr>
<td><code>t</code> - <code>StOP</code></td>
<td>Timer Stop</td>
<td>No</td>
<td>TSP</td>
</tr>
<tr>
<td><code>c</code> - <code>St</code></td>
<td>Counter Start</td>
<td>No</td>
<td>CST</td>
</tr>
<tr>
<td><code>sp</code> - <code>ON</code></td>
<td>Setpoint ON</td>
<td>No</td>
<td>SPT</td>
</tr>
<tr>
<td><code>sp</code> - <code>OFF</code></td>
<td>Setpoint OFF</td>
<td>No</td>
<td>SOF</td>
</tr>
<tr>
<td><code>0</code> - <code>tOut</code></td>
<td>Setpoint Time-out</td>
<td>No</td>
<td>STO</td>
</tr>
</tbody>
</table>
Sending Serial Commands and Data

When sending commands to the meter, a string containing at least one command character must be constructed. A command string consists of a command character, a value identifier, numerical data (if writing data to the meter) followed by a command terminator character, * or $.

Command Chart

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Node (meter) Address Specifier</td>
<td>Address a specific meter. Must be followed by one or two digit node address. Not required when node address = 0.</td>
</tr>
<tr>
<td>T</td>
<td>Transmit Value (read)</td>
<td>Read a register from the meter. Must be followed by a register ID character.</td>
</tr>
<tr>
<td>V</td>
<td>Value Change (write)</td>
<td>Write to register of the meter. Must be followed by a register ID character and numeric data.</td>
</tr>
<tr>
<td>R</td>
<td>Reset</td>
<td>Reset a value or the output. Must be followed by a register ID character.</td>
</tr>
<tr>
<td>P</td>
<td>Block Print Request (read)</td>
<td>Initiates a block print output. Registers in the print block are selected in Print Options.</td>
</tr>
</tbody>
</table>

Command String Construction

The command string must be constructed in a specific sequence. The meter does not respond with an error message to illegal commands. The following procedure details construction of a command string:

1. The first 2 or 3 characters consist of the Node Address Specifier (N) followed by a 1 or 2 character node address number. The node address number of the meter is programmable. If the node address is 0, this command and the node address itself may be omitted. This is the only command that may be used in conjunction with other commands.
2. After the optional address specifier, the next character is the command character.
3. The next character is the register ID. This identifies the register that the command affects. The P command does not require a register ID character. It prints all the active selections chosen in the Print Options menu parameter.
4. If constructing a value change command (writing data), the numeric data is sent next.
5. All command strings must be terminated with the string termination characters * or $. The meter does not begin processing the command string until this character is received. See timing diagram figure for differences in meter response time when using the * and $ terminating characters.

Receiving Data From The Meter

Data is transmitted from the meter in response to either a transmit command (T), a block print request command (P) or a User Input print request. The response from the meter is either a full field transmission or an abbreviated transmission, depending on the selection chosen in Module 5.

Full Field Transmission

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2</td>
<td>2 byte Node address field [00–99]</td>
</tr>
<tr>
<td>3</td>
<td>&lt;SP&gt; (Space)</td>
</tr>
<tr>
<td>4-6</td>
<td>3 byte Register Mnemonic field</td>
</tr>
<tr>
<td>7-18</td>
<td>12 byte data field; 9 bytes for number and three bytes for decimal points</td>
</tr>
<tr>
<td>19</td>
<td>&lt;CR&gt; (carriage return)</td>
</tr>
<tr>
<td>20</td>
<td>&lt;LF&gt; (line feed)</td>
</tr>
<tr>
<td>21</td>
<td>&lt;SP&gt;* (Space)</td>
</tr>
<tr>
<td>22</td>
<td>&lt;CR&gt;* (carriage return)</td>
</tr>
<tr>
<td>23</td>
<td>&lt;LF&gt;* (line feed)</td>
</tr>
</tbody>
</table>

* These characters only appear in the last line of a block print.

The first two characters transmitted are the meter address. If the address assigned is 0, two spaces are substituted. A space follows the meter address field. The next three characters are the register mnemonic, as shown in the Register Identification Chart.

The numeric data is transmitted next. The numeric field (bytes 7 to 18) is 12 characters long. When a display overflow exists for a requested timer or cycle counter value, an * (used as an overflow character) replaces a space in byte 7. Byte 8 is always a space.

The remaining ten positions of this field consist of seven positions for the requested value with decimal points positioned for the selected timer range. The data within bytes 9 to 18 is right-aligned with leading spaces for any unfilled positions.

The end of the response string is terminated with a <CR> and <LF>. After the last line of a block print, an extra <SP>, <CR> and <LF> are added to provide separation between the print blocks.

Abbreviated Transmission

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-12</td>
<td>12 byte data field, 9 bytes for number and three bytes for decimal points</td>
</tr>
<tr>
<td>13</td>
<td>&lt;CR&gt; (carriage return)</td>
</tr>
<tr>
<td>14</td>
<td>&lt;LF&gt; (line feed)</td>
</tr>
<tr>
<td>15</td>
<td>&lt;SP&gt;* (Space)</td>
</tr>
<tr>
<td>16</td>
<td>&lt;CR&gt;* (carriage return)</td>
</tr>
<tr>
<td>17</td>
<td>&lt;LF&gt;* (line feed)</td>
</tr>
</tbody>
</table>

* These characters only appear in the last line of a block print.

The abbreviated response suppresses the node address and register mnemonic, leaving only the numeric part of the response.

Meter Response Examples:

1. Node address = 17, full field response, Cycle Counter = 875
   17 CNT 875 <CR><LF>

2. Node address = 0, full field response, Setpoint On value = 250.5
   SPT 250.5<CR><LF>

3. Node address = 0, abbreviated response, Setpoint On value= 250, last line of block print
   250<CR><LF><SP><CR><LF>

Register Identification Chart

<table>
<thead>
<tr>
<th>ID</th>
<th>Value Description</th>
<th>Mnemonic</th>
<th>Applicable Commands</th>
<th>Transmit Details (T and V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Timer</td>
<td>TMR</td>
<td>T, V, R</td>
<td>6 digit, per Timer Range</td>
</tr>
<tr>
<td>B</td>
<td>Cycle Counter</td>
<td>CNT</td>
<td>T, V, R</td>
<td>5 digit</td>
</tr>
<tr>
<td>C</td>
<td>Timer Start</td>
<td>TST</td>
<td>T, V</td>
<td>6 digit, per Timer Range</td>
</tr>
<tr>
<td>D</td>
<td>Timer Stop</td>
<td>TSP</td>
<td>T, V</td>
<td>6 digit, per Timer Range</td>
</tr>
<tr>
<td>E</td>
<td>Counter Start</td>
<td>CST</td>
<td>T, V</td>
<td>5 digit</td>
</tr>
<tr>
<td>F</td>
<td>Setpoint On (Reset Output)</td>
<td>SPT</td>
<td>T, V, R</td>
<td>per Setpoint Assignment, same as Timer or Counter</td>
</tr>
<tr>
<td>G</td>
<td>Setpoint OFF</td>
<td>SOF</td>
<td>T, V</td>
<td>per Setpoint Assignment, same as Timer or Counter</td>
</tr>
<tr>
<td>H</td>
<td>Setpoint Time-out</td>
<td>STO</td>
<td>T, V</td>
<td>6 digit, mm.ss.ss format</td>
</tr>
</tbody>
</table>

Command String Examples:

1. Node address = 17, Write 350 to the Setpoint On value
   String: N17VT350$ |

2. Node address = 5, Read Timer value, response time of 50 msec min
   String: NS5A*

3. Node address = 0, Reset Setpoint output
   String: RF*

4. Node address = 31, Request a Block Print Output, response time of 2 msec min
   String: N31P$
**Command Response Time**

The meter can only receive data or transmit data at any one time (half-duplex operation). During RS232 transmissions, the meter ignores commands while transmitting data, but instead uses RXD as a busy signal. When sending commands and data to the meter, a delay must be imposed before sending another command. This allows enough time for the meter to process the command and prepare for the next command.

At the start of the time interval \( t_1 \), the computer program prints or writes the string to the com port, thus initiating a transmission. During \( t_1 \), the command characters are under transmission and at the end of this period, the command terminating character (\('*\) or \('$\) is received by the meter. The time duration of \( t_1 \) is dependent on the number of characters and baud rate of the channel.

\[
t_1 = \frac{10 \times \text{# of characters}}{\text{baud rate}}
\]

At the start of time interval \( t_2 \), the meter starts the interpretation of the command and when complete, performs the command function. This time interval \( t_2 \) varies. If no response from the meter is expected, the meter is ready to accept another command.

If the meter is to reply with data, the time interval \( t_2 \) is controlled by the use of the command terminating character. The \('*\) terminating character results in a response time of 50 msec. minimum. This allows sufficient time for the release of the sending driver on the RS485 bus. Terminating the command line with \('$\) results in a response time (\( t_2 \)) of 2 msec. minimum. The faster response time of this terminating character requires that sending drivers release within 2 msec. after the terminating character is received.

At the beginning of time interval \( t_3 \), the meter responds with the first character of the reply. As with \( t_1 \), the time duration of \( t_2 \) is dependent on the number of characters and baud rate of the channel. At the end of \( t_3 \), the meter is ready to receive the next command.

\[
t_3 = \frac{10 \times \text{# of characters}}{\text{baud rate}}
\]

The maximum serial throughput of the meter is limited to the sum of the times \( t_1, t_2 \) and \( t_3 \).

---

**Communication Format**

Data is transferred from the meter through a serial communication channel. In serial communications, the voltage is switched between a high and low level at a predetermined rate (baud rate) using ASCII encoding. The receiving device reads the voltage levels at the same intervals and then translates the switched levels back to a character. The voltage level conventions depend on the interface standard. The table lists the voltage levels for each standard.

<table>
<thead>
<tr>
<th>LOGIC</th>
<th>INTERFACE STATE</th>
<th>RS232*</th>
<th>RS485*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>mark (idle)</td>
<td>TXD,RXD; -3 to -15 V</td>
<td>a-b &lt; -200 mV</td>
</tr>
<tr>
<td>0</td>
<td>space (active)</td>
<td>TXD,RXD; +3 to +15 V</td>
<td>a-b &gt; +200 mV</td>
</tr>
</tbody>
</table>

* Voltage levels at the Receiver

Data is transmitted one byte at a time with a variable idle period between characters (0 to \( \infty \)). Each ASCII character is “framed” with a beginning start bit, an optional parity bit and one or more ending stop bits. The data format and baud rate must match that of other equipment in order for communication to take place. The figures list the data formats employed by the meter.

**Start Bit and Data Bits**

Data transmission always begins with the start bit. The start bit signals the receiving device to prepare for reception of data. One bit period later, the least significant bit of the ASCII encoded character is transmitted, followed by the remaining data bits. The receiving device then reads each bit position as they are transmitted.

**Parity Bit**

After the data bits, the parity bit is sent. The transmitter sets the parity bit to a zero or a one, so that the total number of ones contained in the transmission (including the parity bit) is either even or odd. This bit is used by the receiver to detect errors that may occur to an odd number of bits in the transmission. However, a single parity bit cannot detect errors that may occur to an even number of bits. Given this limitation, the parity bit is often ignored by the receiving device. The LD Timer ignores the parity bit of incoming data and sets the parity bit to odd, even or none (mark parity) for outgoing data.

**Stop Bit**

The last character transmitted is the stop bit. The stop bit provides a significant bit period pause to allow the receiver to prepare to re-synchronize to the start of a new transmission (start bit of next byte). The receiver then continuously looks for the occurrence of the start bit. If 7 data bits and no parity is selected, then 2 stop bits are sent from the meter.
Press PAR key to enter Programming Mode.

LD TIMER PROGRAMMING QUICK OVERVIEW

**Diagram:**
- **Selector (SEL):** Indicates the current selection.
- **Par (PAR):** Represents the Programming Mode aspect.
- **NO:** Exit Programming Mode.

**Nodes:**
- **I-IMP (rRANGE):** Timer Range
- **INP OP:** Timer Input Operation
- **FILTER:** Timer Input Filter
- **t-dir:** Timing Direction
- **t-StP:** Timer Start Value
- **t-StO:** Timer Stop Value
- **FLASH:** Flash Timer Run Indicator
- **r-P-UP:** Timer Run State At Power-up
- **r-P-UP:** Timer Reset At Power-up
- **USr INP:** User Input Function
- **USr RSN:** User Input Assignment
- **Cnt-En:** Cycle Counter Enable
- **C-Src:** Cycle Counter Source
- **C-dir:** Cycle Counter Direction
- **C-StP:** Cycle Counter Start Value
- **C-StO:** Cycle Counter Reset at Power-up
- **rSt-En:** Front Panel Reset Enable
- **Sp-En:** Front Panel Display Select
- **Scroll:** Display Scroll Enable
- **d-LEV:** Display Intensity Level
- **Code:** Programming Security Code
- **FACSET:** Load Factory Default Settings
- **Sp-ASn:** Setpoint Assignment
- **Sp-ACt:** Setpoint Output Action
- **Sp-ON:** Setpoint On
- **Sp-OFF:** Setpoint Off
- **O-OUT:** Setpoint Output Time-out
- **StP-O:** Stop Timer
- **Auto-r:** Timer/Counter Output Reset
- **OrSt-r:** Setpoint Output Reset with Display Reset
- **O-P-UP:** Setpoint Output Power-up State
- **bAud:** Baud Rate
- **dA redirection:** Data Bit
- **Par:** Parity Bit
- **Addr:** Meter Address
- **Abbr:** Abbreviated Printing
- **Pr-OPt:** Print Options

**Flow:**
- **Pro:** Programming Mode
- **End:** Exit Programming Mode
- **Exit Programming**

**Legend:**
- **Par (PAR):** Indicates the Programming Mode aspect.
- **Selector (SEL):** Indicates the current selection.
- **Exit Programming:**
- **Pro:** Programming Mode
- **End:** Exit Programming Mode
LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
GENERAL DESCRIPTION

The Large Serial Slave Display is a versatile display that accepts serial ASCII data from a host device and displays the received characters. The displayable data includes numeric, 7-segment alphabetic and certain punctuation characters.

The 6-digit displays are available in either 2.25" or 4" high red LED digits with adjustable display intensity. The 2.25" high models are readable up to 130 feet. The 4" high models are readable up to 180 feet. Both versions are constructed of a NEMA 4X/IP65 enclosure in light weight aluminum.

The Serial Slave has two internal display buffers, allowing two separate display values or messages to be viewed. The main (primary) display typically shows dynamic data (count, rate, process, etc.), usually received directly from another meter. The secondary display typically shows a fixed message or value, such as a system or machine identifier, or a target production value. The main and secondary displays can be toggled either manually or automatically at a user selected toggle speed. Both displays are retained in memory when power is removed from the unit.

For single meter remote display applications, the Serial Slave can be connected directly to a Red Lion (or compatible) meter with RS232 or RS485 serial communications. The slave can display the meter value on its main display without requiring a PC or other serial interface.

Multiple slaves are connected using an RS485 serial bus. If unique meter addresses are assigned, specific data can be displayed by a single slave on the bus. When multiple slaves are assigned the same address, common data can be displayed by multiple units in different locations.

The serial interface is plug jumper selectable for RS232 or RS485 connections. Serial communications parameters are fully programmable, with baud rates up to 38.4Kbps. Special command characters allow display selection and display intensity adjustment through the serial input. In addition to the serial input, a programmable User Input is provided to perform a variety of meter functions.

SAFETY SUMMARY

All safety regulations, local codes and instructions that appear in this and corresponding literature, or on equipment, must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

The protective conductor terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing system.

SPECIFICATIONS

1. DISPLAY: 6-digit 2.25" (57 mm) or 4" (101 mm) adjustable intensity Red LED
2. POWER REQUIREMENTS:
   - AC Power:
     AC Input: 85 to 250 VAC 50/60 Hz, 14 VA
     DC Out: 11 to 16 VDC @ 50 mA
   - DC Power:
     DC Input: 11 to 16 VDC @ 400 mA max, 7 W
3. SERIAL INPUT: (Jumper Selectable RS232 or RS485):
   - RS485 SERIAL COMMUNICATIONS
     Type: Multi-point balanced interface (non-isolated)
     Baud Rate: 300 to 38400
     Data Format: 7/8 bits; odd, even, or no parity
     Bus Address: 0 to 99; max 32 meters per line
   - RS232 SERIAL COMMUNICATIONS
     Type: Half duplex (non-isolated)
     Baud Rate: 300 to 38400
     Data Format: 7/8 bits; odd, even, or no parity
4. USER INPUT (Programmable Function Input):
   - Active low logic, internal 7.8 KΩ pull-up resistor to +12V.
   - Trigger levels: \(V_{IL} = 1.0 \text{ V max}\); \(V_{IH} = 2.4 \text{ V min}\); \(V_{MAX} = 28 \text{ VDC}\)
   - Response time: 5 msec typ; 100 msec debounce (activation & release)

DIMENSIONS In inches (mm)
5. MEMORY: Nonvolatile EEPROM retains all programming parameters, main and secondary displays when power is removed.

6. CERTIFICATIONS AND COMPLIANCES:

SAFETY
IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

IP65 Enclosure rating (Face only), IEC 529
Type 4X Enclosure rating (Face only), UL50

ELECTROMAGNETIC COMPATIBILITY
Emissions and Immunity to EN 61326: Electrical Equipment for Measurement, Control and Laboratory use.

Immunity to Industrial Locations:
Electrostatic discharge EN 61000-4-2
Criterion A
4 kV contact discharge
8 kV air discharge

Electromagnetic RF fields EN 61000-4-3
Criterion A
10 V/m

Fast transients (burst) EN 61000-4-4
Criterion A2
2 kV power
1 kV signal

Surge EN 61000-4-5
Criterion A2
1 kV L-L, 2 kV L&E power

RF conducted interference EN 61000-4-6
Criterion A
3 V/rms

Emissions: EN 55011
Class B

Notes:
2. DC Power: Shaffner FN610-1/07 line filter installed on DC power cable to comply.

7. CONNECTIONS:
Internal removable terminal blocks used for power and signal wiring.
Remove end plates with ¼" nut driver.
For LD2 and LD4 versions, all wiring is on the right side of the unit.
Wire Strip Length: 0.4" (10 mm)
Wire Gauge: 24-12 AWG copper wire
Torque: 5.3 inch-lbs (0.6 N-m) max

8. ENVIRONMENTAL CONDITIONS:
Operating temperature: 0 to 50 °C
Storage temperature: -40 to 70 °C
Operating and storage humidity: 0 to 85% max. RH (non-condensing)
Altitude: Up to 2,000 meters

9. CONSTRUCTION:
Aluminum enclosure, and steel side panels with textured black polyurethane paint for scratch and corrosion resistance protection. Sealed front panel meets NEMA 4X/IP65 specifications. Installation Category II, Pollution Degree 2.

10. WEIGHT:
LD2SS6P0 - 4.5 lbs (2.04 kg)
LD4SS6P0 - 10.5 lbs (4.76 kg)

---

1.0 Installing the Meter

INSTALLATION
The meter meets NEMA 4X/IP65 requirements when properly installed.

INSTALLATION ENVIRONMENT
The unit should be installed in a location that does not exceed the operating temperature. Placing the unit near devices that generate excessive heat should be avoided.

The unit should only be cleaned with a soft cloth and neutral soap product. Do NOT use solvents.

Continuous exposure to direct sunlight may accelerate the aging process of the front overlay. Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

2.0 Wiring the Meter

EMC INSTALLATION GUIDELINES
Although this meter is designed with a high degree of immunity to Electromagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the meter may be different for various installations. The meter becomes more immune to EMI with fewer I/O connections. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation.

Listed below are some EMC guidelines for successful installation in an industrial environment.

1. The meter should be properly connected to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtails should be made as short as possible. The connection point for the shield depends somewhat upon the application.

Listed below are the recommended methods of connecting the shield, in order of their effectiveness.

a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
c. Connect the shield to common of the meter and leave the other end of the shield unconnected and insulated from earth ground.

3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far as possible from contactors, control relays, transformers, and other noisy components.

5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

   Ferrite Suppression Cores for signal and control cables:
   - Fair-Rite # 0443167251 (RLC# FCOR0000)
   - TDK # 2CAT3035-1330A
   - Steward # 28B2029-0A0

   Line Filters for input power cables:
   - Schaffner # FN610-1/07 (RLC# LFIL0000)
   - Schaffner # FN670-1.8/07
   - Corcom # 1 VR3

   Note: Reference manufacturer's instructions when installing a line filter.

6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.

7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.

   Snubber: RLC# SNUB0000.

---

**WIRING OVERVIEW**

Electrical connections are made via pluggable terminal blocks located inside the meter. All conductors should conform to the meter’s voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that the power supplied to the meter (DC or AC) be protected by a fuse or circuit breaker. When wiring the meter, compare the numbers on the label on the back of the meter case against those shown in wiring drawings for proper wire position.

Strip the wire, leaving approximately 0.4” (10 mm) bare lead exposed (stranded wires should be tinned with solder.) Insert the lead under the correct screw clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.) Each terminal can accept up to one #14 AWG (2.55 mm) wire, two #18 AWG (1.02 mm), or four #20 AWG (0.61 mm).

---

**2.1 POWER WIRING**

The power wiring is made via the 5 position terminal block (TBA) located inside unit (right side).

*Do not power unit from both AC & DC at the same time.*

---

**AC Power**

| Terminal 1: VAC |
| Terminal 2: VAC |
| Terminal 3: Earth Ground |
| Terminal 4: +DC Out |
| Terminal 5: DC Common |

**DC Power**

| Terminal 3: Earth Ground |
| Terminal 4: +DC Input |
| Terminal 5: DC Common |

---

**2.2 USER INPUT WIRING**

The User Input is wired to Terminals 3 and 4 of TBB as shown.

Terminal 3: User Input
Terminal 4: Common

Sinking Logic
2.3 SERIAL WIRING

Serial communications is jumper selectable for RS485 or RS232. From the factory, the unit is defaulted to RS485 communications. If RS232 is desired, both serial jumpers will need changed to the RS232 positions before wiring.

RS485

<table>
<thead>
<tr>
<th>NC</th>
<th>NC</th>
<th>USER</th>
<th>USER</th>
<th>COMM</th>
<th>COMM</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (TXD)</td>
<td>A (TXD)</td>
<td>B (RXD)</td>
<td>B (RXD)</td>
<td></td>
<td></td>
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RS232

<table>
<thead>
<tr>
<th>NC</th>
<th>NC</th>
<th>USER</th>
<th>USER</th>
<th>COMM</th>
<th>COMM</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (TXD)</td>
<td>A (TXD)</td>
<td>B (RXD)</td>
<td>B (RXD)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RS485 Communications

The RS485 communication standard allows the connection of up to 32 devices on a single pair of wires, distances up to 4,000 ft. and data rates as high as 10M baud (the LD is limited to 38.4k baud). The same pair of wires is used to both transmit and receive data. RS485 is therefore always half-duplex, that is, data cannot be received and transmitted simultaneously.

RS232 Communications

RS232 is intended to allow two devices to communicate over distances up to 50 feet. Data Terminal Equipment (DTE) transmits data on the Transmitted Data (TXD) line and receives data on the Received Data (RXD) line. Data Computer Equipment (DCE) receives data on the TXD line and transmits data on the RXD line. The LD emulates a DTE. If the other device connected to the meter also emulates a DTE, the TXD and RXD lines must be interchanged for communications to take place. This is known as a null modem connection. Most computers emulate a DTE device.

3.0 REVIEWING THE FRONT PANEL KEYS AND DISPLAY

KEY | DISPLAY MODE OPERATION | PROGRAMMING MODE OPERATION
---|------------------------|------------------------
PAR | Access Programming Mode | Store selected parameter and index to next parameter
SEL ▲ | Select display (main or secondary) | Advance through selection list/select digit position in parameter value
RST ▼ | Reset display(s) per front panel reset setting | Increment selected digit of parameter value

DISPLAY DESIGNATOR

"." - Decimal point to the far right of the display indicates the secondary display is shown.

If display scroll is enabled, the display will toggle automatically between the main and secondary display at the selected scroll interval.
4.0 Programming the Meter

Programming Mode Entry (PAR Key)
It is recommended all programming changes be made off line, or before installation. The meter normally operates in the Display Mode. No parameters can be programmed in this mode. The Programming Mode is entered by pressing the PAR key. If it is not accessible, then it is locked by either a security code or a hardware lock (See Module 2).

Module Entry (SEL & PAR Keys)
The Programming Menu is organized into two modules. These modules group together parameters that are related in function. The display will alternate between Pr a and the present module. The SEL key is used to select the desired module. The displayed module is entered by pressing the PAR key.

Module Menu (PAR Key)
Each module has a separate module menu (which is shown at the start of each module discussion). The PAR key is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters. After completing a module, the display will return to Pr a ND. Programming may continue by accessing additional modules.

Selection / Value Entry
For each parameter, the display alternates between the present parameter and the selections/value for that parameter. The SEL and RST keys are used to move through the selections/values for that parameter. Pressing the PAR key, stores and activates the displayed selection/value. This also advances the meter to the next parameter.

For numeric values, the value is displayed with one digit flashing (initially the right most digit). Pressing the RST key increments the digit by one or the user can hold the RST key and the digit will automatically scroll. The SEL key will select the next digit to the left. Pressing the PAR key will enter the value and move to the next parameter.

Programming Mode Exit (PAR Key)
The Programming Mode is exited by pressing the PAR key with Pr a ND displayed. This will commit any stored parameter changes to memory and return the meter to the Display Mode. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)

Programming Tips
It is recommended to start with Module 1 and proceed through each module in sequence. When programming is complete, it is recommended to record the parameter programming and lock out parameter programming with the user input or programming security code.

Factory Settings
Factory Settings may be completely restored in Module 2. This is useful when encountering programming problems or in the event of corrupted program data.

Alternating Selection Display
In the explanation of the modules, the following dual display with arrows will appear. This is used to illustrate the display alternating between the parameter on top and the parameter’s Factory Setting on the bottom. In most cases, selections and values for the parameter will be listed on the right.

4.1 Module 1 - Input Setup Parameters (1-1NP)

Module 1 is the programming module for the Input Setup Parameters. This includes the Serial Input setup parameters and the User Input function. Set the Serial Input parameters to match the settings of the host device.

**BAUD RATE**

Set the baud rate to match that of the host device. Normally, the baud rate is set to the highest value that all the serial communications equipment is capable of transmitting and receiving.
This parameter only appears when the Data Bit parameter is set to 7-bit. Set the parity bit to match that of the host device. If parity is set to NO, an additional stop bit is used to force the frame size to 10 bits.

**METER ADDRESS**

```
Addr  0 to 99
```

Enter the meter (node) address. With a single slave unit, an address is not required and a value of zero should be used. This is the case with an RS232 connection, where only one Serial Slave is connected to the host.

With multiple Serial Slaves connected on an RS485 bus, a unique address number must be assigned to each unit in order to send data to a specific slave on the bus. If multiple slaves are assigned the same address (including zero), common data can be sent to, and displayed by multiple slave units on the bus.

**DATA RECEIVE DELAY TIME**

```
delay  000 to 5999
```

Upon receiving a terminating character <CR>, the Serial Slave disables serial data reception for the time duration entered in this parameter. Using a delay allows the Serial Slave to ignore additional characters such as a <LF> or second <CR>, which often follow a serial data string. This value is entered in seconds and hundredths of seconds format, with a 10 msec minimum delay time.

(See "Data Receive Delay Timing" in the Communications section for additional timing details.)

### 4.2 MODULE 2 - DISPLAY AND FRONT PANEL KEY PARAMETERS (2-dSP)

**PARAMETER MENU**

Select:

- **SEL-En**: Secondary Display Enable
- **Scroll**: Display Scroll Interval
- **rSk-E**: Front Panel Display Reset Enable
- **rSk-Up**: Display Reset at Power-Up
- **d-LEU**: Display Intensity Level
- **L-2En**: Leading Zero Enable
- **CodE**: Programming Code
- **dSP**: Load Factory Default Settings
- **Pr**: Program Mode Lock-out

**SECONDARY DISPLAY ENABLE**

```
Sec-En  NO  YES
```

Select YES to enable the secondary display. The decimal point in the far right digit always appears when the secondary display is shown.

**FRONT PANEL DISPLAY SELECT ENABLE (SEL▲)**

```
Sel-En  NO  YES
```

Select YES to allow the SEL▲ key to toggle between the main and secondary displays. This parameter only appears if the secondary display is enabled.

**DISPLAY SCROLL INTERVAL**

```
Scroll  NO  4-SEC  8-SEC  2-SEC  6-SEC  10-SEC
```

Select the time interval at which the display automatically toggles between the main and secondary displays. Select NO to disable automatic scrolling. This parameter only appears if the secondary display is enabled.

**FRONT PANEL DISPLAY RESET ENABLE (RST▼)**

```
rSk-E  Pr, bath  dSP
```

This parameter allows the RST▼ key to reset the main (primary) and/or secondary display (if enabled), or the display which is currently shown (dSP). Select NO to disable the RST▼ key.

*Note: Main display resets to zero. Secondary display resets to all blanks.*

---

**USER INPUT FUNCTION**

This parameter only appears when the Data Bit parameter is set to 7-bit. Set the parity bit to match that of the host device. If parity is set to /0, an additional stop bit is used to force the frame size to 10 bits.

**METER ADDRESS**

```
Addr  0 to 99
```

Enter the meter (node) address. With a single slave unit, an address is not required and a value of zero should be used. This is the case with an RS232 connection, where only one Serial Slave is connected to the host.

With multiple Serial Slaves connected on an RS485 bus, a unique address number must be assigned to each unit in order to send data to a specific slave on the bus. If multiple slaves are assigned the same address (including zero), common data can be sent to, and displayed by multiple slave units on the bus.

**DATA RECEIVE DELAY TIME**

```
delay  000 to 5999
```

Upon receiving a terminating character <CR>, the Serial Slave disables serial data reception for the time duration entered in this parameter. Using a delay allows the Serial Slave to ignore additional characters such as a <LF> or second <CR>, which often follow a serial data string. This value is entered in seconds and hundredths of seconds format, with a 10 msec minimum delay time.

(See "Data Receive Delay Timing" in the Communications section for additional timing details.)

**USER INPUT ASSIGNMENT**

Select the display to which the User Input Function applies. The User Input Assignment only appears if the secondary display is enabled and a selection of reset or display hold is chosen for the User Input Function.

Assignment choices include the main (primary) and/or secondary display, or the display which is shown at the moment the User Input is activated (E41).

*Note: For reset selection, main display resets to zero. Secondary display resets to all blanks.*
Immediate Access

This parameter allows the Main and/or Secondary display (if enabled) to automatically reset when power is applied to the unit.

DISPLAY INTENSITY LEVEL

Enter the desired display intensity level. The display will actively brighten or dim as the level is changed.

LEADING ZERO DISPLAY ENABLE

Select NO to insert blanks in place of any leading zeros received in a serial data string. This is typical when sending numeric values to the slave. Select YES to enable display of any leading zeros in the string. This parameter setting only applies to the Main display.

Serial Slave Communications

Displayable Characters

The ASCII characters that the Serial Slave can display are as follows:

- Alphabetic (7-segment): A, b, B, c, d, E, e, F, G, g, H, h, I, i, J, K, L, l, n, o, p, q, r, S, T, t, u, v, V, W, x, Y, Z
- Numeric: 0 to 9
- Punctuation: period, comma, and colon (all displayed as decimal point); minus (dash), blank
- Other: M, W and X

Non-displayable alphabetic characters will be replaced with a blank if received. These include M, W and X.

Note: Both uppercase and lowercase ASCII characters are accepted. If a displayable difference exists, characters will be shown in the case received.

Display and Serial Buffer Capacity

The Serial Slave display is right aligned and has the capacity of displaying six characters. When less than six characters are received, blank spaces are placed in front of the characters. If more than six characters are received, only the last six are displayed.

The unit has two internal display buffers, allowing two separate values or command strings sent to perform specific display functions. The format for sending data is shown below:

Data sent to the Serial Slave must be formatted as either main display data, secondary display data or command strings sent to perform specific display functions. The format for sending data is shown below:

\[
N \ xx \ I \ d6 \ d5 \ d4 \ d3 \ d2 \ d1 \ <CR>
\]

- N - Required to address a specific slave unit in a multiple unit loop.
- xx - Two-digit meter address. Single digit address requires leading zero.
- I - Format identifier character (see below). Omit for main display data.
- d6-d1 - The last 6 characters before the <CR> will be shown, if displayable. <CR> - Carriage Return (0DH) used as string terminator character.

The format identifier character <I> dictates how the Serial Slave interprets a data string as follows:

(omit) - No character indicates main display data
- # - Indicates secondary display data
- @ - Display select command, followed by display identifier character main <1> or secondary <2> (ex: @1<CR> select main display)
- % - Display intensity command, followed by intensity level character <1> to <5> (ex: %3<CR> set display intensity level to 3)

LOAD FACTORY DEFAULT SETTINGS

The YES selection returns the slave to the factory default settings. The unit will displays !SEG and returns to Pr, with the factory settings loaded.
Data Receive Delay Timing

Upon receiving a string terminator character <CR>, the Serial Slave requires a delay time to process the received data and prepare for the next string. During this delay, the meter disables serial data reception.

The Data Receive Delay Time is programmable in Module 1, with a minimum delay of 10 mSec. By extending this delay, the Serial Slave can ignore data sent by the host which is not intended for display. This data includes additional characters such as a <LF> or redundant <CR>, which might follow a serial data string. This could also include additional data strings sent as part of a data block, where only the first string is intended for the Serial Slave display. In this case, the delay time should be programmed to exceed the total transmission time for the entire data block. This results in the Serial Slave displaying the first string of the data block and disabling data reception during transmission of the additional strings.

The Receive Delay Time must be set to expire at a point where no data is being sent to the Serial Slave. This prevents the unit from enabling data reception in the middle of a character or data string, which could result in an incorrect display when the string is processed.

Timing Diagram for Data Reception

LD SERIAL SLAVE PROGRAMMING QUICK OVERVIEW

LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
MODEL LDD - LARGE DIGIT DISPLAY

- WIDE SELECTION OF INPUT MODULES
- 3.32 INCH (84.4 mm) HIGH DIGITS
- 115/230 VAC SWITCH SELECTABLE
- RUGGED STEEL CONSTRUCTION
- AVAILABLE IN 4 OR 6-DIGIT VERSIONS
- AVAILABLE WITH RED OR GREEN LED DISPLAY
- SEALED FRONT PANEL CONSTRUCTION (NEMA 4/IP65)
- VERSATILE MOUNTING OPTIONS
- TEMPLATE PROVIDED FOR EASY INSTALLATION

DESCRIPTION

The Large Digit Display, Model LDD, is a versatile display which can increase your productivity by offering your plant floor or production area a visual display of their current status, such as counting, rate indication, real time, or any engineering unit required. The LDD is available in either a 4-digit or a 6-digit display version with Red or Green LED displays, that accepts a selection of personality boards to meet your specific application needs (see Personality Module Bulletins for more information).

There are four panel wiring knock-outs provided, two 7/8" (22.2 mm) knock-outs and two 1/2" (12.7 mm) knock-outs. Also provided is a removeable cover located on the rear panel which will expose one open ended cut-out for easy wire installation.

The LDD has a sealed front panel which meets NEMA 4/IP65 requirements for wash-down and dusty environments when properly installed. The 3.32" (84.4 mm) digits are readable to 130 feet (40 M).

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

SPECIFICATIONS

1. DISPLAY: 3.32" (84.4 mm) High, Red or Green LED display.
2. POWER REQUIREMENTS: Switch selectable 115/230 VAC (±10%), 50/60 Hz, 17 VA 4-digit, 21 VA 6-digit (including module).
3. CONSTRUCTION: Steel construction textured with polyurethane paint for scratch and corrosion resistance protection. Front panel meets NEMA 4/IP65 requirements for indoor use when properly installed. Installation Category II, Pollution Degree 2. (Panel gasket included with unit.)
4. ENVIRONMENTAL CONDITIONS:
   Operating Temperature: SEE MODULE LITERATURE
   Storage Temperature: -40 to 70°C
   Operating and Storage Humidity: 85% max. relative (non-condensing) over operating range
   Altitude: Up to 2000 meters

DIMENSIONS In inches [mm]

![Dimensions Diagram]
SPECIFICATIONS (Cont’d)

5. CERTIFICATIONS AND COMPLIANCES:
   SAFETY
   IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
   IP65 Enclosure rating (Face only), IEC 529
   Type 4 Enclosure rating (Face only), UL50


   EMC IMMUNITY: Meets EN 50082-2: Industrial Environment.
   Refer to individual personality module specifications for additional information.

6. MOUNTING REQUIREMENTS:
   Max. panel thickness is 0.375” (9.5 mm).
   Min. panel thickness for NEMA 4/IP65 sealing is 0.125” (3.2 mm).

7. WEIGHT: 8 lbs (3.6 kg) (less module).

Warning: Disconnect all power before installing or removing module.

SET-UP

To place the personality module into the LDD, first remove the rear cover by unscrewing the two captive fasteners. Then, before installing the module into the LDD, configure the module for the specific application by setting all applicable dip switches and jumpers at this time (see accompanying module data sheets). Place the module on the plastic standoffs (see figure 1). Push on the four posts as shown in figure 2 until the carrier snaps into place.

Note: Power should NOT be applied until the terminal block is plugged into the module AND the module is properly installed into the Large Digit Display.

Select the proper voltage by setting the switch to either 115 or 230 volts. Connect the display and power cables to the module to the appropriate connectors on the power supply board (see figure 2).

To program the Intelligent Meter, three normally open momentary pushbuttons are connected to “P”, “UP”, “DOWN”, and common of the LDD (not included with the Intelligent Meter). The Model PGM is a small plastic case with three normally open momentary pushbuttons and 10 feet (3 M) of shielded cable, and is well suited for programming the Intelligent Meter module. Although, any normally open, momentary pushbutton switches can be used. (SEE APPROPRIATE MODULE LITERATURE FOR SET-UP AND OTHER CONNECTIONS.)

To remove module from the LDD, disconnect the display and power cables, then remove the carrier from the standoffs by disengaging the tabs and simultaneously lifting the carrier. Repeat this until the module has cleared all 4 standoffs.

INSTALLATION ENVIRONMENT

The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

The LDD may be cleaned using alcohol compounds such as Isopropanol or methanol. Also, liquid glass cleaners may be used if they do NOT contain ammonia.

NOTE: MINIMAL EXPOSURE OF KETONE SOLVENTS TO THE LDD IS GOING TO CAUSE A WHITENING OF THE DISPLAY OVERLAY.

Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

The LDD is intended to be mounted into an enclosed panel with a gasket to provide a water-tight seal. A gasket and ten 10 to 32 kep nuts are provided for easy installation. The recommended minimum panel thickness for NEMA 4/IP65 applications is 0.125” (3.2 mm). Thinner panels may be used but may distort and not provide a water-tight seal.

For ease of installation, the cardboard template (supplied with the LDD) may be used to mark the holes and cut-out locations on the panel. After the panel cut-out has been completed and deburred, insert the unit with the panel gasket, into the panel as depicted in the drawing (see figure 3). Install the ten kep nuts and tighten evenly for uniform gasket compression.

By using additional hardware, the LDD can be surface-wall mounted, suspended, or bottom mounted. To surface-wall mount the unit, two sets of MB6 brackets are required. To suspend or bottom mount the unit, one set of MB6 brackets is required.
PERSONALITY MODULES
The following Apollo and IM capabilities are available as modules for the Large Digit Display (LDD). These modules are ordered separately from the LDD (see ordering information) and can quickly be installed by the user (see “Set-up” for further details).

<table>
<thead>
<tr>
<th>Application</th>
<th>Model Number</th>
<th>Digit Display Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counting (Totalization)</td>
<td>PBLT0600</td>
<td>4/6-digit</td>
</tr>
<tr>
<td>Tachometer/Rate (Time Base)</td>
<td>PBLR0600</td>
<td>4/6-digit</td>
</tr>
<tr>
<td>Tachometer/Rate (Time Interval)</td>
<td>PBLR6000</td>
<td>4/6-digit</td>
</tr>
<tr>
<td>Process Time (Decimal Point)</td>
<td>PBLPT400</td>
<td>4-digit</td>
</tr>
<tr>
<td>Process Time (Chronometer)</td>
<td>PBLPT500</td>
<td>6-digit</td>
</tr>
<tr>
<td>Real Time Clock/Elapsed Time</td>
<td>PBLCK000</td>
<td>6-digit</td>
</tr>
<tr>
<td>Intelligent Decade Voltmeter (IMD1)</td>
<td>PBD1xxxx</td>
<td>6-digit</td>
</tr>
<tr>
<td>Intelligent Decade Current Meter (IMD2)</td>
<td>PBD2xxx</td>
<td>6-digit</td>
</tr>
<tr>
<td>Intelligent Rate Meter (IMR)</td>
<td>PBLxxxxx</td>
<td>6-digit</td>
</tr>
<tr>
<td>Intelligent Slave Display (IMAS)</td>
<td>PBAxxxxx</td>
<td>6-digit</td>
</tr>
<tr>
<td>Apollo Slave Display (APLSP)</td>
<td>PBLSP600</td>
<td>4/6-digit</td>
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</table>

ORDERING INFORMATION FOR LARGE DIGIT DISPLAY

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDD</td>
<td>4-digit, Red Large Digit Display</td>
<td>LDD04000</td>
</tr>
<tr>
<td>LDD</td>
<td>4-digit, Green Large Digit Display</td>
<td>LDD0G400</td>
</tr>
<tr>
<td>LDD</td>
<td>6-digit, Red Large Digit Display</td>
<td>LDD06000</td>
</tr>
<tr>
<td>LDD</td>
<td>6-digit, Green Large Digit Display</td>
<td>LDD0G600</td>
</tr>
<tr>
<td>M66</td>
<td>Mounting Brackets</td>
<td>MB600000</td>
</tr>
<tr>
<td>ENC7</td>
<td>LDD NEMA 4/IP65 Enclosure</td>
<td>ENC700000</td>
</tr>
<tr>
<td>SHR</td>
<td>Shroud For LDD</td>
<td>SHR10000</td>
</tr>
</tbody>
</table>

ORDERING INFORMATION FOR APOLLO PERSONALITY MODULES

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBLCK</td>
<td>Apollo Real Time Clock Module for use with the 6-digit Large Digit Display</td>
<td>PBLCK000</td>
</tr>
<tr>
<td>PBLPT</td>
<td>Apollo 4-digit Process Time Module for use with the 4-digit Large Digit Display</td>
<td>PBLPT400</td>
</tr>
<tr>
<td>PBLR</td>
<td>Apollo Time Base Rate Module for use with the 4 or 6-digit Large Digit Display</td>
<td>PBLR0600</td>
</tr>
<tr>
<td>PBLRI</td>
<td>Apollo Time Interval Rate Module for use with the 4 or 6-digit Large Digit Display</td>
<td>PBLR1600</td>
</tr>
<tr>
<td>PBLT</td>
<td>Apollo 6-digit Totalizer Module for use with the 4 or 6-digit Large Digit Display</td>
<td>PBLT0600</td>
</tr>
</tbody>
</table>

ORDERING INFORMATION FOR APOLLO INTELLIGENT METER MODULES

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Description</th>
<th>+18 VDC Excitation</th>
<th>Dual Alarm</th>
<th>Serial Output</th>
<th>4-20 mA Analog Output</th>
<th>Part Number</th>
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</thead>
<tbody>
<tr>
<td>PBD1</td>
<td>Intelligent Meter Modules For Decade Voltage Inputs*</td>
<td>NO NO NO NO NO</td>
<td>YES NO NO NO NO</td>
<td>NO NO NO NO NO</td>
<td>PBD10000</td>
<td></td>
</tr>
<tr>
<td>PBD2</td>
<td>Intelligent Meter Modules For Decade Current Input*</td>
<td>NO NO NO NO NO</td>
<td>YES NO NO NO NO</td>
<td>NO NO NO NO NO</td>
<td>PBD20000</td>
<td></td>
</tr>
<tr>
<td>PBA</td>
<td>Intelligent Serial Slave Display Module* (See IMAS Bulletin for operating specifications.)</td>
<td>20 mA SRC 3 5</td>
<td>20 mA SRC 3 5</td>
<td>20 mA SRC 3 5</td>
<td>PBA04014</td>
<td></td>
</tr>
<tr>
<td>PBI</td>
<td>Intelligent Digital Rate Meter* (See IMI Bulletin for operating specifications.)</td>
<td>12 VDC 1 2 3 5 6</td>
<td>12 VDC 1 2 3 5 6</td>
<td>12 VDC 1 2 3 5 6</td>
<td>PBA04017</td>
<td></td>
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<tr>
<td>PGM</td>
<td>Programming Box</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PGM000000</td>
</tr>
</tbody>
</table>

* Note: All the above Intelligent Meter modules require a 6-digit Large Digit Display, Model LDD06000 or LDD0G600.

ORDERING INFORMATION FOR APOLLO BCD SLAVE MODULE

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBLSP</td>
<td>Apollo BCD Slave Display Module for use with 4 or 6-digit Large Digit Display (See APLSP Bulletin for operating specifications.)</td>
<td>PBLSP600</td>
</tr>
</tbody>
</table>

PERSONALITY MODULES

ORDERING INFORMATION FOR LARGE DIGIT DISPLAY

ORDERING INFORMATION FOR APOLLO PERSONALITY MODULES

ORDERING INFORMATION FOR APOLLO INTELLIGENT METER MODULES

ORDERING INFORMATION FOR APOLLO BCD SLAVE MODULE

TROUBLESHOOTING
For further technical assistance, contact technical support at the appropriate company numbers listed.
LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company's products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
MODEL LMC - LARGE MESSAGE CENTER DISPLAY

- FULL MESSAGE CENTER CAPABILITIES IN A LARGE LED DISPLAY
- 5x7 DOT MATRIX, RED LED CHARACTERS
- 2x20 VERSION, 1" (25.4 mm) HIGH CHARACTERS READABLE TO 60 FEET (18 Meters)
- 1x10 VERSION, 2" (50.8 mm) HIGH CHARACTERS READABLE TO 120 FEET (36 Meters)
- LED INTENSITY IS SOFTWARE ADJUSTABLE TO SUIT AMBIENT LIGHT CONDITIONS
- 115/230 VAC SWITCH SELECTABLE
- RUGGED STEEL CONSTRUCTION
- NEMA 4/IP65 SEALED FRONT PANEL
- EASY INSTALLATION WITH VERSATILE MOUNTING OPTIONS

DESCRIPTION

The Large Message Center Display unit (LMC) provides the equivalent capabilities of the Apollo Message Display series of products with a large dot matrix LED display. See the MDI or MDS Bulletin for more information on programming and capabilities. The LMC display characters are red, 5 by 7, dot matrix LED’s, available in either 1 line with 10 characters or 2 lines with 20 characters per line. A Message Display Personality Module (MDP) must be installed to control the LMC display. There are two modules available to meet specific application needs.

The LMC utilizes high-efficiency LED’s to provide maximum brightness for the display with low power dissipation. The display intensity is software adjustable through sixteen levels using the Message Display User Software, via a personality module, to achieve the desired brightness in virtually any ambient lighting condition. The 2” (50.8 mm) high characters of the 1x10 version are readable to 120 feet (36 M), while the 2x20 version uses 1” (25.4 mm) high characters that are readable to 60 feet (18 M).

The LMC has a sealed front panel which meets NEMA 4/IP65 requirements for wash-down and dusty environments when properly installed. A removable rear cover allows easy access to wiring connections. Panel knock-outs; two 7/8” (22.2 mm) and two 1/2” (12.7 mm) fittings, permit wires to be routed neatly to the LMC unit.

SPECIFICATIONS

1. DISPLAY: 5x7 dot matrix, Red LEDs (AlGaAs Technology).
   1x10 Version: 2.0” (50 mm) character height.
   2x20 Version: 1.0” (25 mm) character height.
2. DISPLAY INTENSITY: Software adjustable in 16 increments from full brightness to display off.
3. POWER REQUIREMENTS: Switch selectable 115/230 V AC (±10%), 50/60 Hz, 25 VA 1x10 version, 30 VA 2x20 version (including MDP module).
4. STORAGE TEMPERATURE RANGE: -20°C to 60°C.
5. OPERATING TEMPERATURE RANGE: 0°C to 50°C.
6. MOUNTING REQUIREMENTS: Max. panel thickness is 0.375” (9.5 mm). Min. panel thickness for NEMA 4/IP65 sealing is 0.125” (3.2 mm). (Mounting template, Panel gasket, and keps nuts included with unit.)
7. CONSTRUCTION: Steel construction with textured black polyurethane paint for scratch and corrosion resistance protection. Front panel meets NEMA 4/IP65 requirements.
8. WEIGHT: 8.12 lbs. (3.7 Kg).

DIMENSIONS “In inches [mm]”

- LARGE MESSAGE CENTER DISPLAY
  - 6.00 (152.4)
  - 21.00 (533.4)
  - 5.50 (139.7)
  - 5.00 (127.0)
  - .25 (6.3)
  - .25 (6.3)
  - 5.125 TYP. (130.17)
  - 20.00 (508.0)
  - .44 (11.2) CLOSED
  - .64 (16.3) OPEN
  - .15 (3.8)
  - 3.00 (76.2)
  - 4.95 (123.2)

Bulletin No.  LMC-C
Drawing No.  LP0015
Revised  11/00

Tel +1 (717) 767-6511
Fax +1 (717) 764-6587
www.redlion-controls.com
PERSONALITY MODULES

The Message Display Intelligent (MDPI) and Slave (MDPS) Display Modules are P.C. Board Assemblies mounted in a plastic carrier. A module is installed by the user into either the 1x10 or 2x20 Large Message Center Display. When an MDPI module is installed in an LMC Display, all programming and operating procedures are the same as a standard Message Display Intelligent unit. An MDPS module is the same as a Message Display Slave unit except there is no parallel port option.

Note: An MDI module will only operate with the LMC Display. Do not attempt to install in an LDD.

MDPI/MDPS

- 153 DIFFERENT DISPLAYABLE CHARACTERS (Including 96 standard ASCII characters)
- DISPLAY CUSTOMIZED CHARACTERS
- SCROLLING AND/OR BLINKING CHARACTERS
- ALARM OUTPUT
- SERIAL COMMUNICATIONS, (isolated 20 mA Current Loop)

MDPI Only

- CAPABLE OF STORING 248 MESSAGES
- PRIORITIZED MESSAGES
- REAL TIME CLOCK
- TIME AND DATE FUNCTIONS
- 2 ELAPSED TIMERS
- EMBEDDED DATA
- ALARM/BUSY OUTPUT
- SCROLLING AND/OR BLINKING
- PERIODIC AND/OR CHAINED MESSAGES

MESSAGE QUEUE; HOLDS UP TO EIGHT MESSAGES
- PARALLEL COMMUNICATIONS; 4 or 8 BIT, POSITIVE or NEGATIVE LOGIC

SPECIFICATIONS

1. POWER: AC power is connected to the module but is switch selected via the LMC driver board. See LMC specifications for power requirements.

2. PARALLEL COMMUNICATIONS (MDPI ONLY):

- Message Format:
  - Binary: 4 or 8 bits.
  - BCD: 4, 8, or 9 bits.
- Embedded Data Format:
  - Binary: 4 or 8 bits.
  - BCD: 4 or 8 bits.
  - ASCII: 4 or 8 bits.
- PARALLEL PORT INPUTS:
  - Data (D0-D7) inputs:
    - $V_{IH} = 8$ VDC min., $V_{IL} = 4$ VDC max., $V_{MAX} = 30$ VDC
  - Ctrl (Strobe and message/data) inputs:
    - $V_{IH} = 4$ VDC,
    - $V_{IL} = 1$ VDC, $V_{MAX} = 30$ VDC.
  - Data SNK/SRC:
    - Current sink or source Data inputs, switch selectable.
  - Ctrl SNK/SRC:
    - Current sink or source Control inputs, switch selectable.
  - Data LOGIC:
    - Positive or negative logic for Data inputs, switch selectable.
  - Ctrl LOGIC:
    - Positive or negative logic for Control inputs, switch selectable.
  - Current sinking:
    - Internal 10 KΩ pull-up to +12 VDC, $I_{MAX} = 1.2$ mA.
  - Current sourcing:
    - Internal 10 KΩ pull-down, $I_{MAX} = 3.1$ mA @ 30 VDC.
  - Debounce time: 0.01 to 2.5 seconds (programmable).
  - Strobe time: 3 to 255 msec (programmable).

3. SERIAL COMMUNICATIONS: 20 mA current loop, full duplex.

- Data Format: Four types available, switch selectable.
  - 11 bits: 1 start bit, 8 data bits, 1 parity bit, 1 stop bit.
  - 10 bits: 1 start bit, 8 data bits, 1 stop bit, or 1 start bit, 7 data bits, 1 parity bit, 1 stop bit.
  - 9 bits: 1 start bit, 7 data bits, 1 parity bit, 1 stop bit.
- Data Code: ASCII

Maximum Address: 0 to 99, software selectable. (Actual number in a single loop is limited by serial hardware specifications).

Baud Rate: 300 to 19200, Switch selectable.

Parity: Enable or Disabled, Switch selectable.

Even/Odd: Selects parity type, Switch selectable.

7/8 BIT: Selects number of data bits, Switch selectable.

Serial Hardware: Terminal TBA.

-20mA SRC: Provides 20 mA @ 12 VDC
  (Powers up to 6 units in a loop).

+20mA SRC: Loop return for +20 mA SRC.

SO - Output Transistor Rating: $V_{MAX} = 30$ VDC,

$V_{SAT} = 1 V_{MAX} @ 20$ mA

(Note: This will allow up to 28 units max. in each loop.)

SI - Input Diode Rating: $V_{F} = 1.25 V_{TYP}$, $1.5 V_{MAX} @ 20$ mA.

(Note: The compliance voltage rating of the source must be greater than the sum of the voltage drops around the loop. Typically a 30 VDC powered source would be capable of operating between 18 and 22 units in a loop.)

4. OUTPUT/BUSY PIN:

- Solid State: NPN open-collector, current sinking, $V_{MAX} = 30$ VDC, $I_{MAX} = 100$ mA, $V_{SAT} = 1 V_{MAX} @ 100$ mA.
- Busy Mode: Indicates the Ready/Busy status of the unit.
- Output Mode: Output is activated from a Command or Message for a specified time out value.
- Time Out: 10 msec to 63 mins or Latched.

5. REAL-TIME CLOCK:

- Nonvolatile Date and Time, accurate to 1 minute/month.

6. MDPI MESSAGE MEMORY:

- Nonvolatile.

- 32 K: Provides space for 248 messages of 120 characters each.

- MDS MEMORY: Nonvolatile EPROM memory retains all factory configuration settings when power is removed or interrupted.

7. TEMPERATURE RANGE:

- Operational: 0° to +50°C
- Storage: -20° to +60°C

8. CONSTRUCTION: P.C. Board mounted in a plastic carrier.

9. CONNECTIONS: Removable terminal blocks.

10. WEIGHT: 0.6 lbs (272g)
**INSTALLATION**

The LMC is designed to be panel-mounted with a gasket to provide a watertight seal as shown in Figure 1. A gasket, ten keps nuts (#10-32), and a cardboard template are supplied with the unit. The display overlay may be cleaned using alcohol compounds (Isopropanol or methanol) or liquid glass cleaners that DO NOT contain ammonia. Exposure of the display overlay to ketone solvents will cause it to whiten.

By using optional accessory hardware, the LMC can be surface-wall mounted, suspended, or bottom mounted. To surface-wall mount the unit, two sets of MB6 brackets are required as shown in Figure 2. To suspend or bottom mount the unit, one set of MB6 brackets is required.

**MDPI**

The MDPI module is capable of displaying messages consisting of alphanumeric, extended ASCII, and/or customized characters on an LMC display. Up to 248 messages can be programmed into the MDPI and stored in nonvolatile memory. Communication is accomplished via a serial and/or a parallel port, which can be fully configured to satisfy most requirements. Connections are made on removable terminal blocks to simplify installation.

Messages are requested by sending a message request to the MDPI via the serial or parallel port. A message can be requested by loading a BCD or binary value onto the parallel port and strobing the value in, or by using a computer to automatically request messages via the serial port. Messages can be programmed as periodic and displayed automatically at a specific time. Each message may contain parameters including message scrolling, character blinking, date and/or time fields, embedded data fields, etc. The MDPI has the ability to retrieve data from other Red Lion Controls products with 20 mA serial communications, as well as from various devices such as Programmable Logic Controllers (PLC), and embed the data received into the body of a message.

A unique feature of the MDPI is the Message Queue. The Queue will hold up to eight messages, which allows for multiple message requests without loss of previously requested messages. Messages can be assigned priorities which determine the order in which queued messages will be displayed. The MDPI may also serve as a master controller for Slave units (model MDPS), allowing programmed messages in the MDPI to be displayed at remote locations.

**MDPS**

The MDPS is capable of displaying full alphanumeric information received via the serial port on a 1x10 or 2x20 Large Message Center Display. Information received may be messages from an MDPI, or host computer. A nonvolatile memory retains all configuration set-up information when power is removed.

Other accessory items for the LMC include a shroud, to enhance display readability in areas with extremely high intensity overhead light sources, and a NEMA 4/IP65 Enclosure to provide overall protection from wash-down and dust as shown in Figures 3 and 4.
**MDPI/MDPS PROGRAMMING SET-UP**

The MDPI requires the Apollo Message Display User Software to program messages. Once the module has been installed into a Large Message Center Display, messages are then downloaded to the MDPI from the computer via the serial port, using the Message Display Software. The MDPI will save the messages and perform the appropriate function when the message is requested. Configuration settings initially programmed at the factory can be modified by using the Message Display User Software.

The User Software allows programmed messages to be saved on a floppy or hard disk of an IBM® or IBM® compatible computer. Also the user can simulate any programmed message on the terminal screen assuring the message is programmed to the user’s needs.

Since the MDPS does not store messages, it does not require initial set-up in order to be placed into operation; although the MDPS does have initially programmed configuration settings which can be modified by the User software.

The following items (at right) are required to perform the above objectives and the diagram shows a typical hook-up:

**OPERATION**

**MDPI**

The operation of the MDPI simply involves requesting messages, previously loaded into the MDPI. Requesting a message can be accomplished via the serial port or parallel port. Internal to the MDPI a periodic message is requested automatically, based on time. A default message can be programmed which is requested automatically on power-up.

Messages can display text, retrieve data, activate the alarm output, etc. (Refer to Message Features).

**MDPS**

The MDPS can be configured for either Remote Slave or Serial Slave Mode. The mode selection is accomplished via the serial port by sending the appropriate command.

**Remote Slave Mode**

The Remote Slave Mode displays messages that are transmitted from an MDPI unit to an MDPS unit. The MDPS can also display information transmitted from a host computer provided that the information is in the correct command string format. To display a message on the MDPS from an MDPI, the desired message is requested at the MDPI. This mode of operation allows the MDPS to act as a message library for multiple MDPS units. The MDPS will automatically select character scrolling for message blocks that are longer than the unit’s line length. All units can be addressed separately using the proper control code.

Control codes are used to perform commands which affect scroll rate, blink rate, etc. An internal elapsed timer can also be requested by using the proper Control codes.

**SERIAL PORT**

The serial port is a half duplex, isolated two-way 20 mA current loop. Some typical devices that can be connected to the serial port are; ASCII terminal, programmable controller, host computer, and any Red Lion Controls product with 20 mA current loop. In order for the MDPI or MDPS to communicate to the above devices, they must conform to the same data format, baud rate, address number, etc. An internal Serial Hardware (Loop-Back) test can be performed on the serial port to verify proper operation of the unit.

**MDPI Only**

The serial port can be used to perform the following operations: Request messages; issue commands; request and receive embedded data; and receive files from a computer using the Message Display software. Data transmitted from the MDPI may be the result of embedded data messages, error messages, remote display messages, and certain commands.

**PARALLEL PORT (MDPI ONLY)**

An 8 bit parallel port with separate STROBE and MESSAGE/DATA control lines is provided. DIP switches are used to select either positive or negative logic and source or sink current, for the 8 bit port and control line inputs.

The parallel port can be used to request messages and receive embedded data. The parallel port can be 4, 8, or 9 bits wide and is the same width for both message request and data reception. Except in the 9-bit mode where 9 bits are used to request a message, any data received can only be 8 bits wide. Message requests may be in binary or BCD, whereas, embedded data items may be in binary, BCD, or ASCII. Some typical devices that can be connected to the parallel port are; PLC’s, BCD switches, and indicators with a parallel port.
OUTPUT/BUSY PIN (MDPI only)
The output can be programmed as either an ALARM or BUSY output. As an Alarm output, a message on the LMC display or a command transmitted to the LMC can activate the NPN open collector output.

PROGRAMMED FOR THE BUSY FUNCTION, THE OUTPUT IS USED FOR HARDWARE HANDSHAKING IN WHICH CASE THE OUTPUT WILL BE ACTIVE DURING THE MESSAGE PROCESS TIME. DURING THE PROCESS TIME THE MDPI WILL NOT ACKNOWLEDGE ANY COMMUNICATIONS UNTIL THE PROCESS HAS BEEN COMPLETED.

ALARM OUTPUT (MDPS only)
This output function will set an ALARM output only. The output will be active when a message, programmed for alarm, is received from the MDPI or when an alarm code is received.

MESSAGES (MDPI Only)
Messages are programmed using the Apollo Message Display User Software and loaded into the memory of the MDPI via the serial port. Each message is assigned a specific message number (1-248). Text within a message may contain any of the 153 programmed characters. A message may contain text, time-out, alarm, embedded data, etc.

MESSAGE FEATURES (MDPI/MDPS)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual or single line</td>
<td>Display dependent</td>
</tr>
<tr>
<td>Blinking field(s):</td>
<td>Top line: 0.01 to 2.50 secs.</td>
</tr>
<tr>
<td></td>
<td>Bottom line: 0.01 to 2.50 secs.</td>
</tr>
<tr>
<td>Horizontal scrolling:</td>
<td>Top line: 0.01 to 2.50 secs.</td>
</tr>
<tr>
<td></td>
<td>Bottom line: 0.01 to 2.50 secs.</td>
</tr>
<tr>
<td>Block scrolling:</td>
<td>Top line: 1 to 250 secs.</td>
</tr>
<tr>
<td></td>
<td>Bottom line: 1 to 250 secs.</td>
</tr>
<tr>
<td>Alarm:</td>
<td>Time-out values: Timed = 1 to 250 secs.</td>
</tr>
<tr>
<td></td>
<td>Latched = 0</td>
</tr>
<tr>
<td>Message Time-out</td>
<td>0-250 seconds</td>
</tr>
<tr>
<td>Standard characters</td>
<td>20H to 7FH</td>
</tr>
<tr>
<td>Extended</td>
<td>80H to 8FH</td>
</tr>
<tr>
<td>* Message Destination</td>
<td>Display and/or serial</td>
</tr>
<tr>
<td>* Periodic Messages</td>
<td>Up to 92</td>
</tr>
<tr>
<td>* Chained Message</td>
<td>Up to 248/messages</td>
</tr>
<tr>
<td>* Command Messages</td>
<td>Issues a command</td>
</tr>
<tr>
<td>* Current date/time</td>
<td>Full calendar and clock</td>
</tr>
<tr>
<td>* Request time</td>
<td>Time of Message Request</td>
</tr>
<tr>
<td>* Priority</td>
<td>0 to 248</td>
</tr>
<tr>
<td>* Embedded data</td>
<td>Up to 4 items/message</td>
</tr>
<tr>
<td>** Elapsed time</td>
<td>2 internal timers</td>
</tr>
</tbody>
</table>

** MDPI Only
** MDPS has only one internal timer

ORDERING INFORMATION FOR LARGE MESSAGE CENTER

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMC1</td>
<td>LARGE MESSAGE CENTER 1x10</td>
<td>LMC10000</td>
</tr>
<tr>
<td>LMC2</td>
<td>LARGE MESSAGE CENTER 2x20</td>
<td>LMC20000</td>
</tr>
<tr>
<td>MB6</td>
<td>LMC/LDD MOUNTING BRACKETS</td>
<td>MB600000</td>
</tr>
<tr>
<td>ENC7</td>
<td>LMC/LDD NEMA 4/IP65 ENCLOSURE</td>
<td>ENC700000</td>
</tr>
<tr>
<td>SHR</td>
<td>SHROUD FOR LMC</td>
<td>SHR100000</td>
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</tbody>
</table>

ORDERING INFORMATION FOR APOLLO MESSAGE DISPLAY PERSONALITY MODULE

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDPI</td>
<td>MDPI MODULE</td>
<td>MDPI10000</td>
</tr>
<tr>
<td>MDPS</td>
<td>MDPS MODULE</td>
<td>MDPS00000</td>
</tr>
</tbody>
</table>

Note: 1) These modules will NOT operate in a Model LDD unit.
2) The MDPI requires the Apollo Message Display User Software to program messages.
3) See MDI or MDS Bulletin for more information.

ORDERING INFORMATION FOR MESSAGE DISPLAY ACCESSORIES

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFMD</td>
<td>Apollo Message Display User Software</td>
<td>SFMD0</td>
</tr>
<tr>
<td>MCCA</td>
<td>AC Communications Adapter</td>
<td>MCCA0000</td>
</tr>
<tr>
<td>ENC7</td>
<td>ENC700000</td>
<td>ENC700000</td>
</tr>
<tr>
<td>GCM232</td>
<td>ENC700000</td>
<td>ENC700000</td>
</tr>
<tr>
<td>AFS01</td>
<td>APS010000</td>
<td>APS010000</td>
</tr>
<tr>
<td>APS2</td>
<td>APS020000</td>
<td>APS020000</td>
</tr>
<tr>
<td>SKT1</td>
<td>SKT100000</td>
<td>SKT100000</td>
</tr>
</tbody>
</table>

Note: Only one copy of software is required for multiple units.
* Refer to MDPM/MDPS Programming Setup section for minimum requirements.

APPLICATION MDPI
A plant manager wants to display the date and time in the production area so that it is readable to all employees. The manager also would like the ability to display other information about the production facility such as: desired and actual quantity produced, work stoppage alerts, safety messages, etc.

DISPLAYING MESSAGES (MDPI ONLY)
After a message is requested, the MDPI will determine if the message should be displayed, placed on the Queue, or discarded. If the LMC display is empty, the message is placed on the display. If a message currently occupies the display, the MDPI determines which of the two messages has the higher priority. If the priority of the new message is equal to or greater than the currently displayed message, the new message is displayed and the message on the display is placed on the Queue. If the priority is less than the currently displayed message, the new message will be placed on the Queue.

QUEUE
The Queue is a temporary storage area for messages while the LMC display is currently occupied. This feature can prevent a requested message from being discarded if the display is currently occupied. The Queue can hold up to eight messages.

POWER UP MESSAGE
When the MDPI is powered up, it will display the unit address, serial terminator, and diagnostic results about the Message Display. The series of self-diagnostics will also be transmitted over the serial port.

DEFAULT MESSAGE
One message may be designated as a default message, and on power-up will automatically be requested.

CANCELLATION OF MESSAGES
MDPI
Messages are cancelled by either timing out or by using a command. If the message has been programmed with a Time-Out Value, the message will automatically expire after the time-out value is attained. Time-out values for messages are reset and do not time-out while on the Queue.

Commands may be used to cancel any or all messages. These commands can be sent via the serial port. A “command message” which has been programmed to issue a cancel message command can be requested, over the serial port or the parallel port.

MDPS
If a message time-out value is sent to the MDPS with the message, it will automatically expire after the time-out value is attained. A message can have a time-out value from 1 to 250 seconds. If the message time-out value is NOT sent with the message, the message will remain on the display until a new message is received. Power is removed from the unit a cancel displayed message is sent, or a reset unit command is sent.
MODEL LPAX- 5 DIGIT LARGE PAX DISPLAY FOR ANALOG INPUTS

- LARGE LED DISPLAY READABLE TO 70 FEET
- VARIOUS ANALOG INPUT MODULES;
  - DC VOLTAGE AND CURRENT
  - TRUE RMS VOLTAGE AND CURRENT
  - THERMOCOUPLE OR RTD
  - STRAIN GAGE/Bridge
- ALARMS, ANALOG OUTPUT, AND COMMUNICATION
- CUSTOM UNITS LABEL WITH BACKLIGHT
- PROGRAMMABLE USER INPUTS
- PROGRAMMABLE FUNCTION KEYS
- UNIVERSAL AC/DC POWERED MODELS
- PC SOFTWARE FOR METER CONFIGURATION
- NEMA 4/IP65

GENERAL DESCRIPTION
The LPAX Display is a versatile display that can increase productivity by
offering the plant floor or production area a large visual display of their current
status. Whether your measurement is temperature, weight, or flow, the LPAX
can satisfy your requirement. With the use of a units label and backlighting, the
display can be tailored to show the actual engineering unit, which further
enhances the display. This LPAX display accepts various analog inputs through
the use of input modules (MPAX) which allow the unit to adapt to most any
application. The MPAX Modules offer the same features as our highly
successful PAX Series Panel Meters. Additional plug-in option cards can add
alarms, analog output, and communication/bus capabilities, making the LPAX a
truly Intelligent Panel Meter.

SAFETY SUMMARY
All safety regulations, local codes and instructions that appear in this and
corresponding literature, or on equipment, must be observed to ensure personal
safety and to prevent damage to either the instrument or equipment connected
to it. If equipment is used in a manner not specified by the manufacturer, the
protection provided by the equipment may be impaired.

The protective conductor terminal is bonded to conductive
parts of the equipment for safety purposes and must be
connected to an external protective earthing system.

CAUTION: Read complete
instructions prior to installation
and operation of the unit.

CAUTION: Risk of electric shock.

SPECIFICATIONS
Additional specifications, wiring, programming, and information for the
individual MPAX models are contained in the corresponding standard PAX
literature. This PAX literature is shipped with the ordered MPAX model.

1. DISPLAY: 1.5" (38 mm) Red LED
   5-Digit: (-19999 to 99999)

2. POWER REQUIREMENTS:
   AC Modules: 85 to 250 VAC, 50/60 Hz, 18 VA
   DC Modules: 11 to 36 VDC or 24 VAC ±10%, 50/60 Hz, 14 W

3. INPUT: Accepts analog input modules, see “Selecting your display
   components.”

4. ANNUNCIATORS:
   LPAX0500: MAX, MIN, TOT, SP1, SP2, SP3, and SP4
   Optional units label with backlight

5. KEYPAD: Five tactile membrane switches integrated into the front panel

6. CERTIFICATIONS AND COMPLIANCES:
   UL Recognized Component, File #E179259, UL3101-1, CSA 22.2 No. 1010-1
   Recognized to US and Canadian requirements under the Component
   Recognition Program of Underwriters Laboratories, Inc.
   UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M95
   LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
   Type 4 Enclosure rating (Face only), UL50
   IEEE CB Scheme Test Certificate #US/7470A/UL
   CB Scheme Test Report #03ME009266-08292003
   Issued by Underwriters Laboratories, Inc.
   IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for
   measurement, control, and laboratory use, Part 1.
   IP65 Enclosure rating (Face only), IEC 529

ELECTROMAGNETIC COMPATIBILITY
EMC specifications determined by the MPAX module.

DIMENSIONS  In inches (mm)

PANEL CUT-OUT

Bulletin No.  LPAX-C
Drawing No.  LP0489
Released 1/05
7. ENVIRONMENTAL CONDITIONS:
   Operating Temperature Range: Determined by the MPAX module
   Storage Temperature Range: -40 to 60°C
   Operating and Storage Humidity: 0 to 85% max. RH (non-condensing)
   Altitude: Up to 2000 meters
8. MOUNTING REQUIREMENTS:
   Max. panel thickness is 0.375" (9.5 mm)
   Min. panel thickness for NEMA 4/IP65 sealing is 0.060" (1.57 mm)
9. MODULE INSTALLATION:
   24-pin shrouded connector on LPAX engages connector on MPAX module
   upon installation. Shroud ensures proper alignment by providing a lead-in for
   the module connector.

**About the MPAX Input Modules**

The MPAX Module serves as the input to the LPAX Display. There are several different modules to cover a variety of inputs. The MPAX module provides input scaling which allows the LPAX to display most any engineering unit. Once the MPAX is inserted into the LPAX, the unit has the same functions and capabilities of our PAX Series Intelligent Panel Meters. A full set of PAX programming instructions will be included with the MPAX Module.

*Note: The MPAX provides the operating power for the LPAX; therefore you must select either the AC or DC MPAX corresponding with your application and available power.*

**Selecting Your Display Components**

To build a complete display unit, you will need an LPAX and an MPAX Input Module. The LPAX is only a display and will not operate without an MPAX Module. Please use the following chart to identify the appropriate MPAX Module (including supply power) and LPAX Display that will satisfy your application.

---

**Optional Plug-in Cards and Accessories**

**WARNING:** Disconnect all power to the unit before installing Plug-in cards.

**Adding Option Cards**

The MPAX series meters can be fitted with up to three optional plug-in cards. However, only one card from each function type can be installed at a time. The function types include Setpoint Alarms (PAXCDS), Communications (PAXCDC), and Analog Output (PAXCDL). The cards can be installed initially or at a later date. Each optional plug-in card is shipped with installation and programming instructions.

**Communication Cards (PAXCDC)**

A variety of communication protocols are available for the PAX and MPAX series. Only one of these cards can be installed at a time. When programming the unit via RLC Pro, a Windows® based program, the RS232 or RS485 Cards must be used.

- PAXCDC1* - RS485 Serial
- PAXCDC2* - RS232 Serial
- PAXCDC30 - DeviceNet

*Units available in various connector configurations.

**Setpoint Cards (PAXCDS)**

The MPAX series has four setpoint alarm output plug-in cards. Only one of these cards can be installed at a time. (Logic state of the outputs can be reversed in the programming.) These plug-in cards include:

- PAXCDS10 - Dual Relay, FORM-C, Normally open & closed
- PAXCDS20 - Quad Relay, FORM-A, Normally open only
- PAXCDS30 - Isolated quad sinking NPN open collector
- PAXCDS40 - Isolated quad sourcing PNP open collector

**Linear DC Output (PAXCDL)**

Either a 0(4)-20 mA or 0-10 V retransmitted linear DC output is available from the analog output plug-in card. The programmable output low and high scaling can be based on the input, max, min, or total display value. Reverse slope output is possible by reversing the scaling point positions.

- PAXCDL10 - Retransmitted Analog Output Card

**Units Label (LX)**

The LPAX Display has an area on the front panel designed for a custom units label. The units label is applied directly to the panel in the embossed area. The units backlight is then turned on via programming.

Available on 5-digit version only. Refer to the LPAX Accessories Bulletin for a list of available units labels.

**Programming Software (SFPAX)**

The SFPAX is a Windows® based program that allows configuration of the PAX meter from a PC. Using the SFPAX makes it easier to program the PAX meter and allows saving the PAX program in a PC file for future use. On-line help is available within the software. A PAX serial plug-in card is required to program the meter using the software.

---

**Linear DC Output**

The MPAX series meters can be fitted with up to three optional plug-in cards. However, only one card from each function type can be installed at a time. The function types include Setpoint Alarms (PAXCDS), Communications (PAXCDC), and Analog Output (PAXCDL). The cards can be installed initially or at a later date. Each optional plug-in card is shipped with installation and programming instructions.

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- PAXCDC1* - RS485 Serial
- PAXCDC2* - RS232 Serial
- PAXCDC30 - DeviceNet

*Units available in various connector configurations.

**Setpoint Cards (PAXCDS)**

The MPAX series has four setpoint alarm output plug-in cards. Only one of these cards can be installed at a time. (Logic state of the outputs can be reversed in the programming.) These plug-in cards include:

- PAXCDS10 - Dual Relay, FORM-C, Normally open & closed
- PAXCDS20 - Quad Relay, FORM-A, Normally open only
- PAXCDS30 - Isolated quad sinking NPN open collector
- PAXCDS40 - Isolated quad sourcing PNP open collector

**Linear DC Output (PAXCDL)**

Either a 0(4)-20 mA or 0-10 V retransmitted linear DC output is available from the analog output plug-in card. The programmable output low and high scaling can be based on the input, max, min, or total display value. Reverse slope output is possible by reversing the scaling point positions.

PAXCDL10 - Retransmitted Analog Output Card

**Units Label (LX)**

The LPAX Display has an area on the front panel designed for a custom units label. The units label is applied directly to the panel in the embossed area. The units backlight is then turned on via programming.

Available on 5-digit version only. Refer to the LPAX Accessories Bulletin for a list of available units labels.

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The SFPAX is a Windows® based program that allows configuration of the PAX meter from a PC. Using the SFPAX makes it easier to program the PAX meter and allows saving the PAX program in a PC file for future use. On-line help is available within the software. A PAX serial plug-in card is required to program the meter using the software.
1.0 ASSEMBLING THE DISPLAY

CAUTION: The MPAX main circuit board and the option cards contain static sensitive components. Before handling the module or the cards, discharge static charges from your body by touching a grounded bare metal object. Handle the module by the rear plastic cover only, and the option cards by the board edges. Dirt, oil or other contaminants that contact the circuit boards or components can adversely affect circuit operation.

WARNING: Exposed line voltage exists on the MPAX main circuit board and the option cards. DO NOT apply power to the module OR load circuits until the module is properly installed in the LPAX case.

NOTE: All module and option card labels must be installed as shown for safety purposes.

Prior to installing the LPAX Display, it is recommended that the MPAX and any option cards be assembled first. This will allow you the opportunity to insure all the boards are fitted properly into their connectors.

Installing the Option Cards

If your application requires option cards, they should be installed into the MPAX before it is installed into the LPAX Display. Refer to the literature enclosed with the option cards for installation instruction.

Installing the MPAX

To install the MPAX Module, align the module with the opening in the LPAX case, as illustrated. The module must be oriented as shown, with terminal #1 toward the top of the LPAX case. Carefully slide the module into the LPAX case. The LPAX and MPAX connectors will begin to engage about ¼” from the bottom. At this point, apply a small amount of pressure to the rear of the MPAX module to fully engage the connection. Be sure the module fully snaps into the slots at the rear of the LPAX case. The display is ready for installation.

Installing the Labels

Each option card and the MPAX are shipped with a connection label. These labels must be applied to the rear of the LPAX in the positions shown in the drawing.

Removing The MPAX Module

To remove the MPAX Module from the LPAX Display, first remove all power and load circuits. Then insert a flat screwdriver blade (3/32” or 1/4”) into the narrow slot between the LPAX rear cover plate and the module’s plastic cover as illustrated in Figure 2. Twist the screwdriver in the direction shown to disengage the internal connectors while firmly squeezing and pulling back on the rear finger tabs (top and bottom). Carefully slide the module out of the LPAX case, keeping it properly aligned with the case opening.

Figure 1, Installing an MPAX Module and Option Cards

Figure 2, Removing an MPAX Module
2.0 INSTALLING THE DISPLAY

LPAX DISPLAY INSTALLATION

The LPAX display is intended to be mounted into a panel or enclosure. The display is provided with a gasket to provide a water-tight seal. The recommended minimum panel thickness for NEMA 4/IP65 sealing is 0.060" (1.57 mm).

For panel mounting, prepare the panel cut-out to the dimensions shown. The supplied template may be used to mark the cut-out and hole locations on the panel. After the panel cut-out has been deburred, slide the panel gasket over the rear of the display and onto the mounting studs. Insert the display into the panel cut-out as illustrated in Figure 3. Install six #10-32 keps nuts (supplied) and tighten evenly for uniform gasket compression. Do not over-tighten the nuts.

By using additional mounting accessories, the LPAX can be surface-wall mounted, suspended, or bottom mounted. Separate installation instructions are provided with the mounting accessories.

Environment And Cleaning

The display should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the system near devices that generate excessive heat should be avoided.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

3.0 WIRING AND PROGRAMMING THE DISPLAY

Once assembled, the LPAX and MPAX have all the same functions and capabilities of our PAX Series Intelligent Panel Meters. Therefore, you will find the appropriate PAX information packed with the MPAX Module. Simply follow the instructions to wire and program the display for your application.

TROUBLESHOOTING

For technical assistance, contact technical support.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>LPAX</td>
<td>5-Digit, Large Display for Analog MPAX Modules</td>
<td>LPA0500</td>
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<td>Analog</td>
<td>LPAX</td>
<td>Universal DC Input Module, AC Powered</td>
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<td>Module</td>
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<td>Universal DC Input Module, DC/24 VAC Powered</td>
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<td>Process Input Module, DC/24 VAC Powered</td>
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<td>Thermocouple and RTD Module, AC Powered</td>
<td>MPAXT000</td>
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<td>and RTD Module</td>
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<td>Thermocouple and RTD Module, DC/24 VAC Powered</td>
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<td>RS-232 Serial</td>
<td>MPAX</td>
<td>AC True RMS Voltage and Current Module, AC Powered</td>
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<td>Communications</td>
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<td>Strain Gage Input Module, AC Powered</td>
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<td>MPAXS010</td>
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<td>Optional</td>
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<td>Dual Setpoint Relay Output Card</td>
<td>PAXCD10</td>
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<td>Plug-In</td>
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<td>Quad Setpoint Relay Output Card</td>
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<td>PAXCD11C</td>
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<td>RS-232 Serial Communications Output Card with Terminal Block</td>
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<td>Analog Output Card</td>
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<td>LX</td>
<td>Custom Units Label *</td>
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<td>SFPAX</td>
<td>PC Configuration Software for Windows 95/98 (3.5&quot; disk)</td>
<td>SFPAX</td>
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<td>NEMA 4 Enclosure for LPAX</td>
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<td>SHR</td>
<td>Shroud for LPAX</td>
<td>SHRLPAX00</td>
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<td>MB</td>
<td>Mounting Bracket for LPAX</td>
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</table>

* See the LPAX Accessory Bulletin or our web site for available units labels.
MODEL LPAX-6 DIGIT LARGE PAX DISPLAY FOR DIGITAL INPUTS

- LARGE LED DISPLAY READABLE TO 70 FEET
- VARIOUS DIGITAL INPUT MODULES;
  - COUNT AND RATE INPUT
  - CLOCK/TIMER
  - SERIAL SLAVE
- ALARMS, ANALOG OUTPUT, AND COMMUNICATION
- PROGRAMMABLE USER INPUTS
- PROGRAMMABLE FUNCTION KEYS
- UNIVERSAL AC/DC POWERED MODELS
- PC SOFTWARE FOR METER CONFIGURATION
- NEMA 4/IP65

GENERAL DESCRIPTION

The LPAX Display is a versatile display that can increase productivity by offering the plant floor or production area a large visual display of their current status. Whether your measurement is rate, count, or time, the LPAX can satisfy your requirement. These LPAX displays accept various digital inputs through the use of input modules (MPAX) which allow the unit to adapt to most any application. The MPAX Modules offer the same features as our highly successful PAX Series Panel Meters. Additional plug-in option cards can add alarms, analog output, and communication/bus capabilities, making the LPAX a truly Intelligent Panel Meter.

SAFETY SUMMARY

All safety regulations, local codes and instructions that appear in this and corresponding literature, or on equipment, must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

The protective conductor terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing system.

SPECIFICATIONS

Additional specifications, wiring, programming, and information for the individual MPAX models are contained in the corresponding standard PAX literature. This PAX literature is shipped with the ordered MPAX model.

1. DISPLAY: 1.5" (38 mm) Red LED
   - 6-Digit (LPAX0600): (-999999 to 9999999)
   - 6-Digit (LPAXCK00): (0 to 999999)

2. POWER REQUIREMENTS:
   - AC Modules: 85 to 250 VAC, 50/60 Hz, 18 VA
   - DC Modules: 11 to 36 VDC or 24 VAC ±10%, 50/60 Hz, 14 W

3. INPUT:
   - Accepts digital input modules, see “Selecting Your Display Components and Option Cards.”

4. ANNUNCIATORS:
   - LPAX0600: A, B, C, SP1, SP2, SP3, and SP4
   - LPAXCK00: TMR, CNT, DAT, SP1, SP2, SP3, and SP4

5. KEYPAD:
   - Five tactile membrane switches integrated into the front panel

6. CERTIFICATIONS AND COMPLIANCES:

SAFETY

UL Recognized Component, File #E179259, UL3101-1, CSA 22.2 No. 1010-1
Recognized to US and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M95
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CB Scheme Test Report # 03ME09282-08292003
Issued by Underwriters Laboratories, Inc.
IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
IP65 Enclosure rating (Face only), IEC 529

ELECTROMAGNETIC COMPATIBILITY

EMC specifications determined by the MPAX module.

DIMENSIONS In inches (mm)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
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<tbody>
<tr>
<td>SP1</td>
<td>SP2</td>
<td>SP3</td>
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<td>SP4</td>
</tr>
<tr>
<td>SP1</td>
<td>SP2</td>
<td>SP3</td>
</tr>
</tbody>
</table>

PANEL CUT-OUT

- .234 (6.0) DIA. THRU, TOP
- .08 (2.0)
- 2X 4.725 (120.0)
- 3.67 (92.7)
- 3.54 (90.0)
- 4.25 (107.7)
- 3.85 (97.9)

CAUTION: Read complete instructions prior to installation and operation of the unit.

CAUTION: Risk of electric shock.
7. **ENVIRONMENTAL CONDITIONS:**
   - Operating Temperature Range: Determined by the MPAX module
   - Storage Temperature Range: -40 to 60°C
   - Operating and Storage Humidity: 0 to 85% max. RH (non-condensing)
   - Altitude: Up to 2000 meters

8. **MOUNTING REQUIREMENTS:**
   - Max. panel thickness is 0.375” (9.5 mm)
   - Min. panel thickness for NEMA 4/IP65 sealing is 0.060” (1.57 mm)

9. **MODULE INSTALLATION:**
   - 24-pin shrouded connector on LPAX engages connector on MPAX module
   - Shroud ensures proper alignment by providing a lead-in for the module connector.

---

**About the MPAX Input Modules**

The MPAX Module serves as the input to the LPAX Display. There are several different modules to cover a variety of inputs. The MPAX module provides input scaling which allows the LPAX to display most any engineering unit. Once the MPAX is inserted into the LPAX, the unit has the same functions and capabilities of our PAX Series Intelligent Panel Meters. A full set of PAX programming instructions will be included with the MPAX module.

*Note: The MPAX provides the operating power for the LPAX, therefore you must select either the AC or DC MPAX corresponding with your application and available power.*

**Selecting Your Display Components and Option Cards**

To build a complete display unit, you will need an LPAX and an MPAX Input Module. The LPAX is only a display and will not operate without an MPAX module. Please use the following chart to identify the appropriate MPAX module (including supply power) and LPAX Display that will satisfy your application.

<table>
<thead>
<tr>
<th>SIGNAL TYPE</th>
<th>MPAX MODULES*</th>
<th>LPAX DISPLAYS</th>
<th>OPTIONAL PLUG-IN CARD COMPATABILITY</th>
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<tr>
<td></td>
<td>85-250 VAC</td>
<td>11 to 36 VDC / 24 VAC</td>
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<td>Count/Rate/Serial Slave</td>
<td>MPAXI000</td>
<td>MPAXI010</td>
<td>LPAX0600</td>
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<td>Count</td>
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<td>Rate</td>
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<td>Timer</td>
<td>MPAXTM00</td>
<td>MPAXTM10</td>
<td>LPAXCK00**</td>
</tr>
</tbody>
</table>

*For detailed module and plug-in card specifications, see corresponding PAX literature. (i.e. For MPAXI specifications, see the PAXI literature)

**The LPAXCK will only operate with the Clock/Timer MPAX input module.**

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**OPTIONAL PLUG-IN CARDS AND ACCESSORIES**

**WARNING:** Disconnect all power to the unit before installing Plug-in cards.

**Adding Option Cards**

The MPAX series meters can be fitted with up to three optional plug-in cards. However, only one card from each function type can be installed at a time. The function types include Setpoint Alarms (PAXCDS), Communications (PAXCDC), and Analog Output (PAXCDL). The cards can be installed initially or at a later date. Each optional plug-in card is shipped with installation and programming instructions.

**COMMUNICATION CARDS (PAXCDC)**

A variety of communication protocols are available for the PAX and MPAX series. Only one of these cards can be installed at a time. When programming the unit via RLCPro, a Windows® based program, the RS232 or RS485 Cards must be used.

- PAXCDC10 - RS485 Serial
- PAXCDC20 - RS232 Serial
- PAXCDC30 - DeviceNet
- PAXCDC40 - Modbus
- PAXCDC50 - Profibus-DP

**SETPOINT CARDS (PAXCDS)**

The MPAX series has four setpoint alarm output plug-in cards. Only one of these cards can be installed at a time. (Logic state of the outputs can be reversed in the programming.) These plug-in cards include:

- Dual relay, FORM-C, Normally open & closed
- Quad relay, FORM-A, Normally open only
- Isolated quad sinking NPN open collector
- Isolated quad sourcing PNP open collector

**LINEAR DC OUTPUT (PAXCDL)**

Either a 0(4)-20 mA or 0-10 V retransmitted linear DC output is available from the analog output plug-in card. The programmable output low and high scaling can be based on the input, max, min, or total display value. Reverse slope output is possible by reversing the scaling point positions.

- PAXCDL10 - Retransmitted Analog Output Card

**PROGRAMMING SOFTWARE (SFPAX)**

The SFPAX is a Windows® based program that allows configuration of the PAX meter from a PC. Using the SFPAX makes it easier to program the PAX meter and allows saving the PAX program in a PC file for future use. On-line help is available within the software. A PAX serial plug-in card is required to program the meter using the software.
1.0 ASSEMBLING THE DISPLAY

CAUTION: The MPAX main circuit board and the option cards contain static sensitive components. Before handling the module or the cards, discharge static charges from your body by touching a grounded bare metal object. Handle the module by the rear plastic cover only, and the option cards by the board edges. Dirt, oil or other contaminants that contact the circuit boards or components can adversely affect circuit operation.

WARNING: Exposed line voltage exists on the MPAX main circuit board and the option cards. DO NOT apply power to the module OR load circuits until the module is properly installed in the LPAX case.

NOTE: All module and option card labels must be installed as shown for safety purposes.

Prior to installing the LPAX Display, it is recommended that the MPAX and any option cards be assembled first. This will allow you the opportunity to insure all the boards are fitted properly into their connectors.

Installing the Option Cards
If your application requires option cards, they should be installed into the MPAX before it is installed into the LPAX Display. Refer to the literature enclosed with the option cards for installation instruction.

Installing the MPAX
To install the MPAX Module, align the module with the opening in the LPAX case, as illustrated. The module must be oriented as shown, with terminal #1 toward the top of the LPAX case. Carefully slide the module into the LPAX case. The LPAX and MPAX connectors will begin to engage about ¼” from the bottom. At this point, apply a small amount of pressure to the rear of the MPAX module to fully engage the connection. Be sure the module fully snaps into the slots at the rear of the LPAX case. The display is ready for installation.

Installing the Labels
Each option card and the MPAX are shipped with a connection label. These labels must be applied to the rear of the LPAX in the positions shown in the drawing.

Removing The MPAX Module
To remove the MPAX Module from the LPAX Display, first remove all power and load circuits. Then insert a flat screwdriver blade (⅜” or ⅝”) into the narrow slot between the LPAX rear cover plate and the module’s plastic cover as illustrated in Figure 2. Twist the screwdriver in the direction shown to disengage the internal connectors while firmly squeezing and pulling back on the rear finger tabs (top and bottom). Carefully slide the module out of the LPAX case, keeping it properly aligned with the case opening.

Figure 1, Installing an MPAX Module and Option Cards
Figure 2, Removing an MPAX Module
2.0 INSTALLING THE DISPLAY

LPAX DISPLAY INSTALLATION

The LPAX display is intended to be mounted into a panel or enclosure. The display is provided with a gasket to provide a water-tight seal. The recommended minimum panel thickness for NEMA 4/IP65 sealing is 0.060" (1.57 mm).

For panel mounting, prepare the panel cut-out to the dimensions shown. The supplied template may be used to mark the cut-out and hole locations on the panel. After the panel cut-out has been deburred, slide the panel gasket over the rear of the display and onto the mounting studs. Insert the display into the panel cut-out as illustrated in Figure 3. Install six #10-32 keps nuts (supplied) and tighten evenly for uniform gasket compression. Do not over-tighten the nuts.

By using additional mounting accessories, the LPAX can be surface-wall mounted, suspended, or bottom mounted. Separate installation instructions are provided with the mounting accessories.

ENVIRONMENT AND CLEANING

The display should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the system near devices that generate excessive heat should be avoided.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

3.0 WIRING AND PROGRAMMING THE DISPLAY

Once assembled, the LPAX and MPAX have all the same functions and capabilities of our PAX Series Intelligent Panel Meters. Therefore, you will find the appropriate PAX information packed with the MPAX Module. Simply follow the instructions to wire and program the display for your application.

TROUBLESHOOTING

For technical assistance, contact technical support.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>TYPE</th>
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<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
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<td>6-Digit Display for Digital MPAX Modules</td>
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<td>6-Digit Display for MPAXCK (Clock/Timer) and MPAXTM Only</td>
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<td>Timer Module, DC/24 VAC Powered</td>
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<td>PAXCD5</td>
<td>Dual Setpoint Relay Output Card</td>
<td>PAXCD510</td>
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<td>PAXCD520</td>
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<td>Quad Setpoint Sinking Open Collector Output Card</td>
<td>PAXCD530</td>
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<td>PAXRTC00</td>
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<td>PC Configuration Software for Windows 95/98 (3.5&quot; disk)</td>
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<td></td>
<td>MB</td>
<td>Mounting Bracket for LPAX</td>
<td>MBLPA00</td>
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*Refer to "Selecting Your Display Components and Option Cards."

**Available as a FREE download from the Red Lion website. www.redlion.net
**GENERAL DESCRIPTION**

The LPAXDA Display is a versatile display that can increase productivity by offering the plant floor or production area a large visual display of their current status. With the use of a units label and backlighting, the display can be tailored to show the actual engineering unit, which further enhances the display. This LPAXDA display accepts various analog inputs through the use of input modules (MPAXDP) which allow the unit to adapt to most any application. The MPAXDP Modules offer the same features as our highly successful PAXDP Series Panel Meters. Additional plug-in option cards can add alarms, analog output, and communication/bus capabilities, making the LPAXDA a truly Intelligent Panel Meter.

**SAFETY SUMMARY**

All safety regulations, local codes and instructions that appear in this and corresponding literature, or on equipment, must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

The protective conductor terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing system.

**SPECIFICATIONS**

Additional specifications, wiring, programming, and information for the individual MPAX models are contained in the corresponding standard PAX literature. This PAX literature is shipped with the ordered MPAX model.

1. **DISPLAY:** 1.5" (38 mm) Red LED 5-Digit: (-19999 to 99999)
2. **POWER REQUIREMENTS:**
   - AC Modules: 85 to 250 VAC, 50/60 Hz, 21 VA
   - DC Modules: 18 to 36 VDC, 13 W or 24 VAC ±10%, 50/60 Hz, 16 VA
3. **INPUT:** Accepts analog input modules, see “Selecting your display components.”
4. **ANNUNCIATORS:**
   - LPAXDA00: A, B, C, SP1, SP2, SP3, and SP4
   - Optional units label with backlight
5. **KEYPAD:** Five tactile membrane switches integrated into the front panel
6. **CERTIFICATIONS AND COMPLIANCES:**
   - UL Recognized Component, File #E179259, UL3101-1, CSA 22.2 No. 1010-1
   - Recognized to US and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
   - UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M95
   - LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
   - Type 4 Enclosure rating (Face only), UL50
   - CB Scheme Test Certificate #UL/8843/UL
   - CB Scheme Test Report #04ME1209-20041018
   - Issued by Underwriters Laboratories, Inc.
   - IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
   - IP65 Enclosure rating (Face only), IEC 529

**ELECTROMAGNETIC COMPATIBILITY**

EMC specifications determined by the MPAX module.

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**DIMENSIONS In inches (mm)**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 (3.05)</td>
<td>Height of Display</td>
<td>mm</td>
</tr>
<tr>
<td>4.75 (120.7)</td>
<td>Height of Annunciators</td>
<td>mm</td>
</tr>
<tr>
<td>3.54 (89.9)</td>
<td>Width of Annunciators</td>
<td>mm</td>
</tr>
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<td>3.63 (92.2)</td>
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<td>mm</td>
</tr>
<tr>
<td>4.65 (118.1)</td>
<td>Depth of Display</td>
<td>mm</td>
</tr>
</tbody>
</table>

**PANEL CUT-OUT**

- 224 (5.64) DIA.
- 2X 4.725 (120.0)
7. ENVIRONMENTAL CONDITIONS:
   Operating Temperature Range: Determined by the MPAX module
   Storage Temperature Range: -40 to 60°C
   Operating and Storage Humidity: 0 to 85% max. RH (non-condensing)
   Altitude: Up to 2000 meters
8. MOUNTING REQUIREMENTS:
   Max. panel thickness is 0.375” (9.5 mm)
   Min. panel thickness for NEMA 4/IP65 sealing is 0.060” (1.57 mm)
9. MODULE INSTALLATION:
   24-pin shrouded connector on LPAX engages connector on MPAX module
   upon installation. Shroud ensures proper alignment by providing a lead-in for
   the module connector.

10. CONNECTIONS: All wiring connections are made to the MPAX module
    via high compression cage-clamp terminal blocks. Wiring instructions
    are provided with the MPAX module.

   CAUTION: DISCONNECT ALL POWER BEFORE
   INSTALLING OR REMOVING MODULE

11. CONSTRUCTION: Steel front panel, enclosure, and rear cover with
    textured black polyurethane paint for scratch and corrosion resistance
    protection. Sealed front panel meets NEMA 4/IP65 specifications for indoor
    use when properly installed. Installation Category II, Pollution Degree 2.
    Panel gasket and keps nuts included.
12. WEIGHT: 2.7 lbs (1.2 kg) (less module)

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About the MPAX Input Modules
The MPAX Module serves as the input to the LPAX Display. The MPAX module provides input scaling which allows the LPAX to display most any engineering unit. Once the MPAX is inserted into the LPAX, the unit has the same functions and capabilities of our PAX Series Intelligent Panel Meters. A full set of PAX programming instructions will be included with the MPAX Module.

Note: The MPAX provides the operating power for the LPAX, therefore you must select either the AC or DC MPAX corresponding with your application and available power.

Selecting Your Display Components
To build a complete display unit, you will need an LPAXDP and an MPAXDP Input Module. The LPAX is only a display and will not operate without an MPAX Module. Please use the following chart to identify the appropriate MPAX Module (including supply power) and LPAX Display that will satisfy your application.

<table>
<thead>
<tr>
<th>SIGNAL TYPE</th>
<th>INPUT RANGES</th>
<th>MPAX MODULES *</th>
<th>LPAX DISPLAY</th>
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<td>Dual Process Inputs</td>
<td>0-20 mA or 0-10 VDC</td>
<td>MPAXDP00</td>
<td>LPAXDA00</td>
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<td>MPAXDP10</td>
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</tbody>
</table>

*For detailed Module specifications, see corresponding PAX literature. (i.e. For MPAXDP specifications, see the PAXDP literature)

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OPTIONAL PLUG-IN CARDS AND ACCESSORIES

WARNING: Disconnect all power to the unit before installing Plug-in cards.

Adding Option Cards
The MPAX series meters can be fitted with up to three optional plug-in cards. However, only one card from each function type can be installed at a time. The function types include Setpoint Alarms (PAXCDS), Communications (PAXCDC), and Analog Output (PAXCDL). The cards can be installed initially or at a later date. Each optional plug-in card is shipped with installation and programming instructions.

COMMUNICATION CARDS (PAXCDC)
A variety of communication protocols are available for the PAX and MPAX series. Only one of these cards can be installed at a time. When programming the unit via Crimson, a Windows® based program, the RS232 or RS485 Cards must be used.

- PAXCDC1* - RS485 Serial
- PAXCDC2* - RS232 Serial
- PAXCDC30 - DeviceNet
- PAXCDC4* - Modbus
- PAXCDC50 - Profibus-DP

*Units available in various connector configurations.

SETPOINT CARDS (PAXCDS)
The MPAX series has four setpoint alarm output plug-in cards. Only one of these cards can be installed at a time. (Logic state of the outputs can be reversed in the programming.) These plug-in cards include:

- PAXCDS10 - Dual Relay, FORM-C, Normally open & closed
- PAXCDS20 - Quad Relay, FORM-A, Normally open only
- PAXCDS30 - Isolated quad sinking NPN open collector
- PAXCDS40 - Isolated quad sourcing PNP open collector

LINEAR DC OUTPUT (PAXCDL)
Either a 0(4)-20 mA or 0-10 V retransmitted linear DC output is available from the analog output plug-in card. The programmable output low and high scaling can be based on the input, max, min, or total display value. Reverse slope output is possible by reversing the scaling point positions.

PAXCDL10 - Retransmitted Analog Output Card

UNITS LABEL (LX)
The LPAX Display has an area on the front panel designed for a custom units label. The units label is applied directly to the panel in the embossed area. The units backlight is then turned on via programming.

Refer to the LPAX Accessories Bulletin for a list of available units labels.

PROGRAMMING SOFTWARE
Crimson 2 (SFCRD2) is a Windows® based program for configuring and updating the firmware of the MPAXDP meter from a PC. Using Crimson 2 makes programming the MPAXDP meter easier and allows the user to save the MPAXDP database in a PC file for future use. Crimson is available as a free download from Red Lion’s website, or it can be purchased on CD.

The first time Crimson 2 is run from the File menu, select “New” to display a dialog and select the MPAXDP. The screen will display icons that represent the various programming sections of the MPAXDP. Double-click on an icon to configure the programming parameters pertaining to the selection. Tool Tip help is available for each of the program parameters. A PAX serial plug-in card is required to program the meter using the software.
1.0 ASSEMBLING THE DISPLAY

**CAUTION:** The MPAX main circuit board and the option cards contain static sensitive components. Before handling the module or the cards, discharge static charges from your body by touching a grounded bare metal object. Handle the module by the rear plastic cover only, and the option cards by the board edges. Dirt, oil or other contaminants that contact the circuit boards or components can adversely affect circuit operation.

**WARNING:** Exposed line voltage exists on the MPAX main circuit board and the option cards. **DO NOT** apply power to the module or load circuits until the module is properly installed in the LPAX case.

**NOTE:** All module and option card labels must be installed as shown for safety purposes.

Prior to installing the LPAX Display, it is recommended that the MPAX and any option cards be assembled first. This will allow you the opportunity to insure all the boards are fitted properly into their connectors.

**Installing the Option Cards**
If your application requires option cards, they should be installed into the MPAX before it is installed into the LPAX Display. Refer to the literature enclosed with the option cards for installation instructions.

**Installing the MPAX**
To install the MPAX Module, align the module with the opening in the LPAX case, as illustrated. The module must be oriented as shown, with terminal #1 toward the top of the LPAX case. Carefully slide the module into the LPAX case. The LPAX and MPAX connectors will begin to engage about ¼" from the bottom. At this point, apply a small amount of pressure to the rear of the MPAX module to fully engage the connection. Be sure the module fully snaps into the slots at the rear of the LPAX case. The display is ready for installation.

**Installing the Labels**
Each option card and the MPAX are shipped with a connection label. These labels must be applied to the rear of the LPAX in the positions shown in the drawing.

**Removing The MPAX Module**
To remove the MPAX Module from the LPAX Display, first remove all power and load circuits. Then insert a flat screwdriver blade (³⁄₃₂" or ¹⁄₄") into the narrow slot between the LPAX rear cover plate and the module’s plastic cover as illustrated in Figure 2. Twist the screwdriver in the direction shown to disengage the internal connectors while firmly squeezing and pulling back on the rear finger tabs (top and bottom). Carefully slide the module out of the LPAX case, keeping it properly aligned with the case opening.

---

**Figure 1, Installing an MPAX Module and Option Cards**

**Figure 2, Removing an MPAX Module**
2.0 INSTALLING THE DISPLAY

**LPAX DISPLAY INSTALLATION**

The LPAX display is intended to be mounted into a panel or enclosure. The display is provided with a gasket to provide a water-tight seal. The recommended minimum panel thickness for NEMA 4/IP65 sealing is 0.060" (1.57 mm).

For panel mounting, prepare the panel cut-out to the dimensions shown. The supplied template may be used to mark the cut-out and hole locations on the panel. After the panel cut-out has been deburred, slide the panel gasket over the rear of the display and onto the mounting studs. Insert the display into the panel cut-out as illustrated in Figure 3. Install six #10-32 keps nuts (supplied) and tighten evenly for uniform gasket compression. Do not over-tighten the nuts.

By using additional mounting accessories, the LPAX can be surface-wall mounted, suspended, or bottom mounted. Separate installation instructions are provided with the mounting accessories.

**Environment And Cleaning**

The display should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the system near devices that generate excessive heat should be avoided.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

![Figure 3, Installing The LPAX Into A Panel](image)

3.0 WIRING AND PROGRAMMING THE DISPLAY

Once assembled, the LPAX and MPAX have all the same functions and capabilities of our PAX Series Intelligent Panel Meters. Therefore, you will find the appropriate PAX information packed with the MPAX Module. Simply follow the instructions to wire and program the display for your application.

**TROUBLESHOOTING**

For technical assistance, contact technical support.

**ORDERING INFORMATION**

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<tr>
<th>TYPE</th>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
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<td>MB</td>
<td>Mounting Bracket for LPAX</td>
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* See the LPAX Accessory Bulletin or our web site for available units labels.